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NORTH CAROLINA STATE RECORD

NORTH CAROLINA STATE

OF THE UNIVERSITY OF
NORTH CAROLINA AT RALEIGH

1964 - 1966 GENERAL CATALOG

NORTH CAROLINA STATE RECORD

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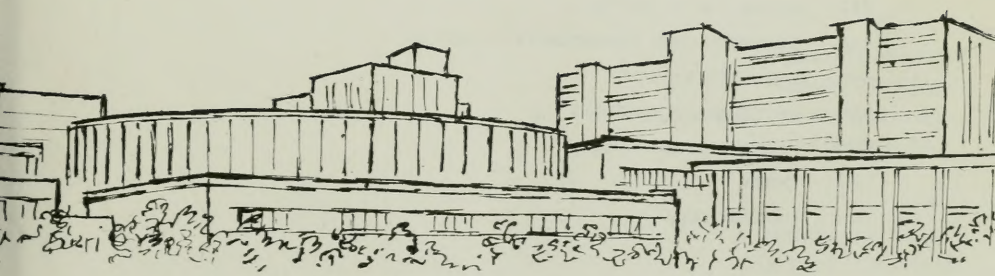

TY OF NORTH CAROLINA AT RALEIGH

1964-1966 GENERAL CATALOG

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NORTH CAROLINA STATE

OF THE UNIVERSITY OF NORTH CAROLINA AT RALEIGH

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HOLLADAY HALL, THE OLDEST BUILDING ON CAMPUS, WAS ONCE THE ENTIRE COLLEGE PLANT. ERECTED IN 1889 AND NAMED FOR COL. ALEXANDER Q. HOLLADAY, FIRST PRESIDENT OF THE SCHOOL, THE BUILDING NOW HOUSES THE MAIN ADMINISTRATIVE OFFICES.

MEMORIAL TOWER IS RECOGNIZED AS THE TRADITIONAL SYMBOL OF NORTH CAROLINA STATE. THE 122 FOOT TOWER, A MEMORIAL TO STATE ALUMNI LOST IN WORLD WAR I, IS EQUIPPED WITH CARILLON BELLS WHICH RING OUT THE ALMA MATER THREE TIMES DAILY.

THE D. H. HILL LIBRARY, IMPORTANT AMONG STATE'S RESEARCH FACILITIES, HOUSES A GROWING COLLECTION OF BOOKS. RECENT ACQUISITIONS REFLECT INCREASING CAMPUS INTEREST IN THE LIBERAL ARTS AND STRONG RESEARCH PROGRAMS IN THE FIELDS OF SCIENCE AND ENGINEERING.

THE GENERAL LABORATORIES BUILDING, JOINED TO HARRELSON HALL BY A RAMP, PROVIDES LABORATORY AND OFFICE SPACE FOR THE SCHOOL OF PHYSICAL SCIENCES AND APPLIED MATHEMATICS.

THE ERDAHL-CLOYD UNION IS A CENTER FOR CAMPUS ACTIVITIES AND A FAVORITE MEETING PLACE FOR STUDENTS. THE UNION SPONSORS A WIDE RANGE OF CULTURAL AND RECREATIONAL EVENTS.

HARRELSON HALL HOUSES STATE'S NEWEST SCHOOL, LIBERAL ARTS. THE BUILDING'S CIRCULAR DESIGN MAKES IT A CAMPUS LANDMARK AS WELL AS A MOST FUNCTIONAL CLASSROOM BUILDING.

WATAUGA HALL, RECENTLY REMODELED AND REDECORATED, IS NOW THE FIRST WOMEN'S DORM AT STATE.

WITHIN THE STUDENT SUPPLY STORE A STUDENT WILL FIND A VARIETY OF BOOKS RANGING FROM THE LATEST PAPERBACK TO THE MOST UP-TO-DATE SCIENTIFIC ENCYCLOPEDIA. SCHOOL SUPPLIES, SPORTS EQUIPMENT, GIFT ITEMS AND OTHER STUDENT NEEDS ARE ALSO FOR SALE HERE.

WILLIAM NEAL REYNOLDS COLISEUM, ONE OF AMERICA'S LARGEST INDOOR STADIUMS, IS THE HOME OF WOLFPACK BASKETBALL. THE "FRIENDS OF THE COLLEGE" CONCERT SERIES ALSO TAKES ADVANTAGE OF THE 12,400 SEAT CAPACITY AUDITORIUM.

HARRIS CAFETERIA IS CONVENIENTLY LOCATED NEAR STATE'S NEW DORMS. THE AIR CONDITIONED CAFETERIA ACCOMMODATES 650 PERSONS IN COMFORTABLE, ATTRACTIVE SURROUNDINGS.

THE BURLINGTON NUCLEAR REACTOR LABORATORIES HOUSES THE FIRST COLLEGE OWNED AND OPERATED NUCLEAR REACTOR. THE LABS ARE THE CENTER FOR RESEARCH ON PEACETIME APPLICATION OF ATOMIC ENERGY.

LEE DORMITORY IS STATE'S FIRST HIGH-RISE RESIDENCE HALL. COMPLETED IN 1964, THE NINE STORY BUILDING HOUSES 840 MEN IN FUNCTIONAL EIGHT MAN SUITES.

BRAGAW DORMITORY, HOUSING MORE THAN 800 MEN, IS ONE OF STATE'S MOST MODERN RESIDENCES. THE DORM IS DESIGNED WITH OUTSIDE CORRIDORS AND SUITE LIVING ARRANGEMENTS SIMILAR TO LEE.

WILLIAM D. CARMICHAEL GYMNASIUM, HEADQUARTERS FOR STATE'S EXCELLENT INSTRUCTIONAL PROGRAM OF PHYSICAL TRAINING, IS ALSO THE SCENE OF MANY INTRAMURAL COMPETITIONS. THE GYM HOUSES BASKETBALL, HANDBALL, AND SQUASH COURTS, A SWIMMING POOL, CLASSROOMS, AND OTHER ATHLETIC FACILITIES.

FRATERNITY ROW IS A UNIVERSITY OWNED FRATERNITY HOUSING CENTER. TWELVE INDIVIDUAL HOUSES, OPENED IN 1964, PROVIDE ATTRACTIVE LIVING ACCOMMODATIONS FOR FRATERNITY MEN.

ADMINISTRATION

NORTH CAROLINA STATE

CHANCELLOR

JOHN TYLER CALDWELL, B.S., M.A., PH.D., "A" Holladay Hall

ACADEMIC AFFAIRS

HARRY C. KELLY, B.S., M.S., PH.D., *Dean of the Faculty*, "A" Holladay Hall

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CHARLES W. WILLIAMS, *Assistant Business Manager*, Holladay Hall
JOHN D. WRIGHT, *Director of Budgeting and Accounting*, Holladay Hall
JOHN C. WILLIAMS, *Director of Purchasing*, 107 1911 Building
J. MCCREE SMITH, *Director of Physical Plant*, Morris Building
E. E. DURHAM, *Director of Auxiliary Services*, Holladay Hall
J. R. SWIGER, *Director of Personnel Services*, Primrose Hall

STUDENT AFFAIRS

JAMES J. STEWART, JR., *Dean*, 101 Holladay Hall

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KENNETH D. RAAB, *Director*, 112 Peele Hall

Student Activities
BANKS C. TALLEY, JR., *Director*, 202 Peele Hall

Religious Programs
OSCAR B. WOOLDRIDGE, JR., *Director*, King Religious Center

Music Activities
J. PERRY WATSON, *Director*, 104 Pullen Hall

College Union
HENRY BOWERS, *Director*, Erdahl-Cloyd Union

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NORBERT B. WATTS, *Director*, 203 Peele Hall
JAMES W. FULGHUM, JR., *Housing Rental Officer*, Leazer Hall

Department of Counseling
LYLE B. ROGERS, *Director*, 205 Peele Hall
KINGSTON JOHNS, JR., *Financial Aid Officer*, 205 Peele Hall

Student Health Service
JOSEPH J. COMBS, *University Physician*, Clark Infirmary

SCHOOLS OF INSTRUCTION

Agriculture and Life Sciences
H. BROOKS JAMES, *Dean*, 115 Patterson Hall
E. W. GLAZENER, *Director of Instruction*, 111 Patterson Hall
J. N. YOUNG, *Assistant Director of Instruction*, 109 Patterson Hall

Design
HENRY L. KAMPHOEFNER, *Dean*, 200 Brooks Hall

Education
J. BRYANT KIRKLAND, *Dean*, 119 Tompkins Hall

Engineering
RALPH E. FADUM, *Dean*, 229 Riddick Building
ROBERT G. CARSON, JR., *Associate Dean*, 232 Riddick Building

Forestry
RICHARD J. PRESTON, *Dean*, 160 Kilgore Hall

Liberal Arts
FRED V. CAHILL, JR., *Dean*, 162 Harrelson Hall

Physical Sciences and Applied Mathematics
ARTHUR C. MENIUS, JR., *Dean*, 104 General Laboratories Building
WESLEY O. DOGGETT, *Assistant Dean*, 105 General Laboratories Building

Textiles
MALCOLM E. CAMPBELL, *Dean*, 101 Nelson Building

Graduate School
WALTER J. PETERSON, *Dean*, 104 Peele Hall

LIBRARY

ISAAC T. LITTLETON, *Acting Director*, 126 D. H. Hill Library
HARLAN C. BROWN, *Associate Director*, 301 D. H. Hill Library

GENERAL EXTENSION

EDWARD W. RUGGLES, *Director*, 118 1911 Building

NEWS BUREAU

HARDY D. BERRY, *Director*, 202 Holladay Hall

ACADEMIC CALENDAR

FALL SEMESTER, 1964

September 7-8	Monday-Tuesday	New student orientation.
September 8	Tuesday	General faculty meeting.
September 9	Wednesday	Registration day for all new students and all other students not preregistered. Late registration fee of $5 payable by all who register after Sept. 9.
September 10-11	Thursday-Friday	New student orientation continued.
September 14	Monday	First day of classes.
September 16	Wednesday	Last day to register.
September 18	Friday	Last day to withdraw with refund less $7 registration fee. Last day to add a course.
September 25	Friday	Last day to drop courses without grades.
November 7	Saturday	Mid-term reports due.
November 24	Tuesday	Thanksgiving holidays begin at 6:00 p.m.
November 30	Monday	Classes resume at 8:00 a.m.
December 17	Thursday	Christmas holidays begin at 6:00 p.m.
January 4, 1965	Monday	Classes resume at 8:00 a.m.
January 13	Wednesday	Last day of classes.
January 14	Thursday	Reading day.
January 15-22	Friday-Friday	Final examinations.

SPRING SEMESTER, 1965

January 26	Tuesday	New student orientation.
January 27	Wednesday	Registration day for all new students and all other students not preregistered. Late registration fee of $5 payable by all who register after Jan. 27.
February 1	Monday	First day of classes.
February 3	Wednesday	Last day to register.
February 5	Friday	Last day to withdraw with refund less $7 registration fee. Last day to add a course.

February 12	Friday	Last day to drop courses without grades.
March 20	Saturday	Mid-term reports due.
April 14	Wednesday	Easter holidays begin at 6:00 p.m.
April 20	Saturday	Classes resume at 8:00 a.m.
May 19	Wednesday	Last day of classes.
May 20	Thursday	Reading day.
May 21-28	Friday-Friday	Final examinations.
May 29	Saturday	Commencement.

SUMMER SESSIONS, 1965

First Session

June 11	Friday	New student orientation.
June 14	Monday	Registration and payment of fees. Late registration fee of $5 payable by all who register after 1:00 p.m., June 14.
June 15	Tuesday	First day of classes.
June 18	Friday	Last day for registration. Last day to withdraw with refund less $7 registration fee, and last day to drop courses without grades.
July 20	Tuesday	Last day of classes.
July 21	Wednesday	Final examinations.

Second Session

July 21	Wednesday	New student orientation.
July 22	Thursday	Registration and payment of fees. Late registration fee of $5 payable by all who register after 12:00 noon, July 22.
July 23	Friday	First day of classes.
July 29	Thursday	Last day for registration. Last day to withdraw with refund less $7 registration fee, and last day to drop courses without grades.
August 26	Thursday	Last day of classes.
August 27	Friday	Final examinations.

FALL SEMESTER, 1965

September 6-7	Monday-Tuesday	New student orientation.
September 7	Tuesday	General faculty meeting.
September 8	Wednesday	Registration for all students who did not preregister and for all preregistered students changing courses. Late registration fee of $5 payable by all who register after Sept. 8.
September 9-10	Thursday-Friday	New student orientation continued.
September 13	Monday	First day of classes.
September 15	Wednesday	Last day to register.
September 17	Friday	Last day to withdraw with refund less $7 registration fee. Last day to add a course.
October 8	Friday	Last day to drop courses without grades.
November 6	Saturday	Mid-term reports due.
November 15-December 1	Monday-Wednesday	Preregistration. All students continuing in the spring semester must see advisors.
November 23	Tuesday	Thanksgiving holidays begin at 6:00 p.m.
November 29	Monday	Classes resume at 8:00 a.m.
December 18	Saturday	Christmas holidays begin at 1:00 p.m.
January 3, 1966	Monday	Classes resume at 8:00 a.m.
January 12	Wednesday	Last day of classes.
January 13	Thursday	Reading day.
January 14-21	Friday-Friday	Final examinations.

SPRING SEMESTER, 1966

January 25	Tuesday	New student orientation.
January 26	Wednesday	Registration for all students who did not preregister and for all preregistered students changing courses. Late registration fee of $5 payable by all who register after Jan. 26.
January 31	Monday	First day of classes.

February 2	Wednesday	Last day to register.
February 4	Friday	Last day to withdraw with refund less $7 registration fee. Last day to add a course.
February 25	Friday	Last day to drop courses without grades.
March 19	Saturday	Mid-term reports due.
March 28-April 15	Monday-Friday	Preregistration. All students continuing in the fall semester must see advisors.
April 6	Wednesday	Easter holidays begin at 6:00 p.m.
April 12	Tuesday	Classes resume at 8:00 a.m.
May 18	Wednesday	Last day of classes.
May 19	Thursday	Reading day.
May 20-27	Friday-Friday	Final examinations.
May 28	Saturday	Commencement.

SUMMER SESSIONS, 1966

First Session

June 6	Monday	New student orientation.
June 7	Tuesday	Registration and payment of fees. Late registration fee of $5 payable by all who register after 1:00 p.m., June 7.
June 8	Wednesday	First day of classes.
June 13	Monday	Last day for registration. Last day to withdraw with refund less $7 registration fee, and last day to drop courses without grades.
July 4	Monday	Holiday.
July 14	Thursday	Last day of classes.
July 15	Friday	Final examinations.

Second Session

July 18	Monday	New student orientation.
July 19	Tuesday	Registration and payment of fees. Late registration fee of $5 payable by all who register after 12:00 noon, July 19.

July 20	Wednesday	First day of classes.
July 25	Monday	Last day to register. Last day to withdraw with refund less $7 registration fee, and last day to withdraw without grades.
August 24	Wednesday	Last day of classes.
August 25	Thursday	Final examinations.

GENERAL INFORMATION

THE UNIVERSITY OF NORTH CAROLINA

(Three Component Institutions)

WILLIAM CLYDE FRIDAY, B.S., LL.B., LLD., *President*

DONALD BENTON ANDERSON, PH.D., *Vice-President for Academic Affairs*

ARNOLD KIMSEY KING, A.B., A.M., PH.D., *Vice-President for Institutional Studies*

FREDERICK HENRY WEAVER, A.M., *Vice-President for Administration*

ALEXANDER HURLBUTT SHEPARD, JR., M.S., *Business Officer and Treasurer*

By the act of the General Assembly of 1931 the University of North Carolina at Chapel Hill, the North Carolina College for Women at Greensboro, and the North Carolina State College of Agriculture and Engineering at Raleigh were consolidated into The University of North Carolina.

By the act of the General Assembly of 1963 effective July 1, 1963, the University of North Carolina comprises: The University of North Carolina at Chapel Hill, The University of North Carolina at Greensboro, and North Carolina State of The University of North Carolina at Raleigh.

Each institution has its own faculty and student body, and each is headed by a chancellor as its chief administrative officer. Unified general policy and appropriate allocation of function are effected by a single Board of Trustees and by the President with other administrative officers of the consolidated University. Administrative offices are located in Chapel Hill.

Members of the Board of Trustees are elected by the Legislature, and the Governor of North Carolina is chairman ex officio. A current list of members of the Board of Trustees is given in the section on Administration and Faculty.

The chancellors of the component institutions are responsible to the President as the principal executive officer of The University of North Carolina.

NORTH CAROLINA STATE

North Carolina State is a land-grant institution, founded in 1887 in the tradition of the great public state colleges and universities then being founded throughout the nation. These institutions were created under the federal Morrill Act of 1862 and were dedicated to expanding the opportunities for higher education. Once primarily "agricultural and mechanic arts" institutions, these schools now constitute the major public universities of the nation, pursuing all fields of knowledge and carrying out programs in every area of the world.

HISTORY

State began operations as the North Carolina College of Agriculture and Mechanic Arts in 1889 with 45 students enrolled. The present enrollment totals more than 8,000 men and women, with better than 1,000 students engaged in graduate study.

State's name has been changed three times in its history, in each instance the result of the expansion of the college's programs, or in connection with major legislation providing for the orderly development of higher education in North Carolina. In 1917 State was renamed North Carolina State College of Agriculture and Engineering, and in 1931 "of the University of North Carolina" was added when the North Carolina General Assembly established the Consolidated University of North Carolina.

State's present title was adopted in 1963, a name change which officially recognized State's increasing educational role, while reaffirming the concept of one consolidated state university composed of several campuses.

ACADEMIC PROGRAMS

The eight undergraduate academic divisions at State are the Schools of Agriculture and Life Sciences, Design, Education, Engineering, Forestry, Liberal Arts, Physical Sciences and Applied Mathematics, and Textiles.

In the three-quarters of a century since its founding, the institution's research, extension and academic programs have grown to embrace the work of more than 1,000 professional staff members, eight undergraduate schools, the graduate school, 16 branch agricultural experiment stations, and agents in each of North Carolina's 100 counties. The total annual budget for North Carolina State currently approaches $30 million.

North Carolina State is accredited by the Southern Association of Colleges and Schools and the North Carolina College Conference. In addition, individual schools and departments are accredited by various associations in their respective fields. State holds memberships in the

Association of State Universities and Land-Grant Colleges, the American Council on Education, the College Entrance Examination Board, the National Commission on Accrediting, the Oak Ridge Institute of Nuclear Studies, and the Southern Association of Colleges and Schools.

SERVICES

As the programs for research and study at State have developed and become more complex, special institutes and curricula have been established, extending the school's educational effectiveness. Today the scope of State's educational responsibility reaches far beyond the program of formalized academic instruction. Among the major service agencies at North Carolina State is the Division of General Extension which annually sponsors more than 100 short courses, workshops, and conferences covering a wide variety of subjects.

Of special service to the rural population of the State is the Agricultural Extension Service, which maintains offices in every North Carolina county, and is responsible for the administration of an effective state-wide 4-H program. Sixteen agricultural experiment stations are also under the supervision of the University. Serving the industrial element of the State in a similar extension program, the Industrial Extension Service renders technical assistance throughout North Carolina.

Current programs for fisheries research and tree improvement are illustrative of the University's work with problems of special concern to North Carolinians.

On the international level, State is carrying out three separate programs of education and research, involving staff and faculty in international educational cooperation.

Through its expanded operations, State has increased its services to the people of North Carolina; its diverse programs in teaching, research and extension have added to State's prestige throughout the State, the nation, and the world.

CAMPUS

North Carolina State is located in Raleigh, situated on the boundary separating the broad coastal plains on the East from the rolling terrain of the Piedmont on the West, about midway between the northern and southern boundaries of the State.

The main campus covers 2,500 acres and is valued at more than $50 million. The physical plant includes 75 major classroom, laboratory, and auxiliary facilities buildings. Construction programs are constantly in progress; new buildings provide well-equipped laboratories and classrooms for research and study, modern dormitory space, and excellent athletic facilities.

Adjoining the central campus are the agricultural farms. In addi-

tion to these holdings in the Raleigh area, forest farms and extensive experimental woodlands are located in the three major geographical areas of the State.

D. H. HILL LIBRARY

Library facilities at North Carolina State include the main D. H. Hill Library and two special libraries for the Schools of Design and Textiles. The collections, totaling more than 300,000 volumes, have been carefully selected to serve the educational and research programs of the University.

The D. H. Hill Library contains particularly strong research holdings in the biological and physical sciences, in all fields of engineering, agriculture and forestry. The 6,000 volume Friedrich F. Tippmann Collection in the field of entomology and related biological sciences is one of the outstanding collections in the country. A carefully selected collection of books and journals in the humanities and social sciences is especially helpful for undergraduate students.

Emphasizing the major teaching and research interests at State is a comprehensive collection of scientific journals. Approximately 4,400 journals are received regularly, and a large collection of state and federal government publications further strengthens the library's research holdings. The D. H. Hill Library is a depository for publications of the Atomic Energy Commission and the Food and Agricultural Organization of the United Nations, and has been a depository for federal documents since 1923.

The Textiles Library, located in Nelson Textile Building, contains outstanding holdings in textiles and textile chemistry. It is regarded as one of the best textile libraries in the country. The School of Design Library, in Brooks Hall, has a very fine collection of books, journals, and slides in the fields of architecture, landscape architecture and product design.

In addition to its own resources, and as a further aid to graduate and faculty research and study, the library participates in an interlibrary loan program with the University of North Carolina at Chapel Hill and Duke University, making the library resources of these two universities easily accessible to students and faculty of North Carolina State.

The library offers a good selection of books for recreational reading. The open shelf arrangement for this collection allows students to browse at leisure.

Besides housing the rapidly expanding book collection, the well-planned and equipped library building provides attractive reading rooms, conference rooms and private studies for students and faculty.

The spacious, well-lighted West Reading Room extends a cheerful invitation to study. In addition to this room, a smaller study on the third floor is also open to undergraduates. For graduate students

there are desks and private lockers in the stacks, and a study room is available for graduate students and faculty.

ADMISSIONS

To be admitted to a regular session of North Carolina State, an applicant must be of good moral character and present evidence of acceptable preparation for work at the college level. Applicants from North Carolina must stand a reasonable chance for academic success; out-of-state applicants must generally stand an excellent chance for success before admission can be granted.

Every applicant must complete an application form which may be obtained from:

Director of Admissions
Peele Hall
North Carolina State
Raleigh, North Carolina

The completed form should be returned to the above address by December 1 for consideration for the spring semester and by May 1 for consideration for the fall semester. A $10 fee should accompany all applications for admission. This fee will be refunded to those who are denied admission. It will be applied to the general fees of those who are cleared for admission and who subsequently register for the semester for which application was made.

ADMISSION TO FRESHMAN STANDING

To be admitted as a freshman, the applicant normally should be a graduate of an accredited secondary school and have the recommendation of his principal or headmaster. Applications of non-graduates will be considered, provided there is evidence of maturity and ability to deal effectively with college work.

Important considerations in determining admission to North Carolina State include: courses taken, grades, rank in class, aptitude test scores, and the program to which entrance is sought. Approximately 80 percent of the freshmen enrolling in September, 1963, were in the top two-fifths of their high school graduating classes and over 90 percent had Scholastic Aptitude Test mathematical scores above 450. However, meeting these scholastic levels alone does not guarantee admission; all factors related to academic success are considered when evaluating a prospective student's application for admission.

An applicant's secondary school preparation should emphasize the traditional academic subjects. The most effective program would include:

English—Four years study with wide reading and extensive opportunity for writing is strongly recommended.

Mathematics—Two years of algebra and one year of geometry should be the minimum preparation. The course in geometry may be of the traditional type, or a one-year course devoted mainly to plane geometry but including some work in analytic or solid geometry. The inclusion of some topics from solid geometry is particularly recommended. Students who plan to enter agricultural engineering, mathematics education, architecture, product design, the School of Engineering, or the School of Physical Sciences and Applied Mathematics are also urged to include advanced algebra and trigonometry in their preparation to avoid delay in their college program of study.

Foreign Language—The study of a single modern foreign language (Spanish, French, German, or Russian) for at least two years is desirable and is recommended, particularly for students who plan to enter the School of Liberal Arts. The liberal arts student who begins his college work without this background in foreign language will be delayed in his normal progress.

Science—At least two years are recommended, including biology and chemistry or physics.

Social Studies—At least two years, including a year's course in United States history, are recommended.

Applicants for admission as freshmen (except applicants from countries whose native language is not English) must take the Scholastic Aptitude Test of the College Entrance Examination Board and request their scores be submitted to the Office of Admissions. This test should ordinarily be taken in December (preferred date) or January of the senior year. If not available at the local high school, application forms and information booklets may be obtained by writing to:

College Entrance Examination Board
Box 592
Princeton, New Jersey

North Carolina State does not have a specific early decision plan. However, all applications are considered and acted upon as soon as complete admissions credentials are received. Before an application normally can be considered, it is necessary for a student to have completed his junior year, for his school record to reflect the courses being pursued in his senior year, and for his scores on the Scholastic Aptitude Test to have been received in the Office of Admissions.

ADMISSION OF TRANSFER STUDENTS

Transfer students with less than 29 semester hours of transferable credit must meet the admissions criteria for entering freshmen as outlined above. To be admitted as a nonfreshman transfer student, the applicant must have acquired a minimum of 29 semester hours of transferable college work (the equivalent of sophomore standing) at an accredited institution. The applications of transfer students from

non-accredited institutions will be reviewed by the Admissions Committee.

All applicants for transfer must have at least an overall "C" average on work taken at other institutions and must be eligible to return to the last institution regularly attended. A transfer applicant whose residence is outside North Carolina may be required to present a somewhat higher average. A student whose records show below "C" average work cannot be admitted unless such admission is approved by the Admissions Committee.

If cleared for admission, the transfer student's record will be evaluated by the dean or director of instruction of the school in which the student wishes to enroll. A $2 transcript evaluation fee, payable to North Carolina State, is charged for this service. Evaluation by the school will be final. No previously earned credit can be disregarded in evaluating a student's record.

Students eligible to continue at other units of the University may transfer even though they do not have an overall "C" average. Students transferring between units of the University will receive credit and honor points for all courses taken at the other units.

All transfer students must have official transcripts sent to the Office of Admissions directly from each college attended. Failure of the student to submit a transcript from all colleges previously attended may result in his dismissal.

ADMISSION OF UNCLASSIFIED STUDENTS

An unclassified student is one who is earning college credit but is not working toward a degree at North Carolina State. Admission of an unclassified student requires the recommendation of the dean of the school in which the student wishes to enroll. Unclassified students must meet the same admissions requirements as regular students. If, at a later date, an unclassified student wishes to change to regular status, his credits must be evaluated for his major. Credits earned by the student while he is unclassified will be accepted only if he has completed the proper prerequisites. Where credit is allowed, the student will receive the grades he earned in the courses accepted.

ADMISSION OF SPECIAL STUDENTS

Students desiring to take college credit courses for special reasons and who do not desire to work for a degree may enroll as special students. The usual college admission requirements may be waived for mature students, but regular rules of scholarship will apply after admission. If special students wish to change to regular status at a later date, they must meet the same admission requirements as regular students. The special student may not represent North Carolina State in any intercollegiate contest or become a member of any fraternity—professional or social.

ADMISSION AS AN AUDITOR

Admission as an auditor requires the permission of the department head. The participation of auditors in class discussion and in tests or examinations is optional with the instructor. Auditors receive no college credit; they are expected, however, to attend classes regularly.

READMISSION OF FORMER NORTH CAROLINA STATE STUDENTS

To be readmitted after having withdrawn or having been out of school for one or more semesters, the student must be academically eligible to return and should apply to the Department of Admissions and Registration for readmission at least 30 days prior to the date of desired enrollment.

ADMISSION OF GRADUATE STUDENTS

All students working toward advanced degrees are enrolled in the Graduate School. Procedures and policies governing graduate admission are outlined in a special catalog issued by the Graduate School. Any student interested in enrolling for graduate study may obtain a copy of the Graduate School Catalog from:

Dean of the Graduate School
Peele Hall
North Carolina State
Raleigh, North Carolina

GRADES AND SCHOLARSHIP

GRADING SYSTEM

North Carolina State operates on a credit-point system. Semester credits represent the number of hours completed with a passing grade; quality points are determined by the grade earned.

A	*Excellent*	*4 quality points for each credit hour.*
B	*Good*	*3 quality points for each credit hour.*
C	*Average*	*2 quality points for each credit hour.*
D	*Passing*	*1 quality point for each credit hour.*
F, FA, FD, FI	*Failing*	*0 quality points for each credit hour.*
W	*Withdrew from course passing*	*0 credit hours and 0 quality points.*
AB	*Absent from examination*	*0 credit hours and 0 quality points.*
AU	*Audit*	
IN	*Incomplete*	
S	*Satisfactory (for graduate students)*	

U *Unsatisfactory (for graduate students)*
P *Passed (for graduate students)*
*D** *Failure removed by re-examination (for seniors only)*
H *Indicates work of outstanding quality (for Chapel Hill graduate students)*
P *Indicates clearly satisfactory work (for Chapel Hill graduate students)*
L *Indicates low passing work (for Chapel Hill graduate students)*

EXPLANATIONS

At the discretion of the teacher, a student who has at least a "C" average in a course may be given an "Incomplete" grade for work not completed because of a serious interruption in his work, not caused by the student's own negligence. An incomplete must be made up during the next semester the student is in residence, unless the department involved is not able to allow the make-up. In the latter case, the department will notify the student and the Office of Registration when the incomplete must be made up. Any incomplete not removed during the period specified by the department will automatically become a failure and will be recorded as "FI".

A grade of "FA" is recorded for an unexcused absence from the final examination. If an absence from examination is excused, the student must arrange to take the examination during the next semester he is in residence or a grade of "FA" will be recorded.

A grade of "FD" is posted if a student has unofficially dropped a course for which he has been scheduled, or if he has officially dropped the course after the final date for dropping courses without grades. A failure may be made up only by repeating the subject. Such a repeat course must be regularly scheduled on the student's roster.

Any student who fails a course within two semesters of graduation (Summer School counts as one semester), and who fails only one course during that semester, may apply to the Office of Registration for permission to remove that failure by standing a re-examination on the total subject matter of the course. If a senior fails more than one course during the next to the last semester and removes all but one of these deficiencies by repeating the course or courses, and if he has not had another re-examination, he may apply at the end of his last semester in residence for permission to take a re-examination. When such a re-examination is taken to remove an "F", only the re-examination grade will be counted. A senior who has passed a re-examination will have his grade for this course changed from "F" to D*, which is equivalent in quality points to a grade of "D". A fee of $5.00 will be charged for administering such a re-examination.

SCHOLASTIC LOADS

A student may not carry more than 21 semester hours during a regular semester, without securing the written approval of the dean

or director of instruction of his school. For a six-week summer session a student must have the same approval, if he carries more than seven semester hours. Veterans or other students receiving federal educational benefits must meet the work load requirements of the appropriate federal agency.

SCHOLARSHIP STANDARDS

Semester Rule

Any student carrying 12 or more semester hours must pass at least six hours of work each semester in which he is registered at North Carolina State. A student carrying less than 12 hours must pass at least half of the work rostered in order to continue.

Grade-point Average Requirements

The following table gives the cumulative grade-point average requirements for the various stages of advancement in terms of hours carried (effective September 1, 1964):

Hours Carried (passed and failed)	Grade-point Average to Continue	Grade-point Average Below which Student is on Provisional Status
less than 20	0.50	1.25
20 - 28	1.00	1.25
29 - 62	1.25	1.50
63 - 96	1.50	1.75
97 - 119	1.75	1.90
120 and over	1.90	2.00

Summer study will be open to students suspended for academic reasons at the end of the preceding fall or spring semester. Correspondence and extension courses may be used in the same manner as summer study. Any exceptions to these rules regarding continuation or readmission will be dealt with individually by the Admissions Committee. Provisional status gives warning that the student must make definite improvement in standing before he reaches the next level in terms of hours carried if he is to be permitted to remain at the University. Students on provisional status shall be limited to a maximum of 15 credit hours in a regular semester.

A student in the School of Engineering must have earned a minimum grade of "C" on MA 102 to be eligible to roster courses taught by the School of Engineering above the freshman level.

Graduation Requirements

A student is scholastically eligible for graduation when he has satisfied all the specific requirements of his department, his school, and the University, and has earned at least a cumulative 2.0 average.

Students who have satisfactorily completed the requirements for more than one bachelor's degree may, upon the recommendation of

their deans and payment of a double diploma fee, be awarded two bachelor's degrees at the same or at different commencement exercises.

To be graduated with high honors, a student must have attained a 3.5 quality point average on all semester hours of work taken at this institution (or at one or both of the other units of the University of North Carolina).

To be graduated with honors, a student must have attained a 3.0 quality point average on all semester hours of work taken at this institution (or at one or both of the other units of the University of North Carolina).

Residence Requirement

A candidate for the bachelor's degree who transfers from some other institution must spend at least one academic year in residence and earn a minimum of 24 semester hours of credit before being eligible for a degree. Residence at either of the other two units of the University of North Carolina satisfies the residence requirement at this institution.

Classification Requirements

Students progress from one class to a higher class after they have completed the required number of hours for the next classification. At the present time students are classified at the beginning of the fall semester and at no other time. The required number of hours for each classification is as follows:

Freshman	*1-28 semester hours of earned credit*
Sophomore	*29-62 semester hours of earned credit*
Junior	*63-96 semester hours of earned credit*
Senior	*97 or more semester hours of earned credit*
Professional (School of Design)	*140 or more semester hours*

OPPORTUNITIES FOR SUPERIOR STUDENTS

Advanced placement is offered to those who, because of their demonstrated abilities, are qualified to accelerate their studies. To obtain advanced placement at least three options are available. The student may take a proficiency examination in any subject when he believes that he already has mastery of the course material; application for such an examination must be made to the head of the department in which the subject is offered. Secondly, advanced placement and credit is given for satisfactory performance on the subject matter proficiency tests of the College Entrance Examination Board's Advanced Placement Program. Finally, the entering student may be selected for an advanced section in English, mathematics, or chemistry on the basis of his previous academic record and/or an examination given prior to the beginning of classes.

Optional programs of advanced training for gifted underclassmen are offered by the departments of mathematics, physics, chemistry, and English. These superior student programs provide interested and capable students with the opportunity for enjoying more challenging and independent work. Honors programs for upperclassmen in engineering, physical sciences and applied mathematics, forestry, and agriculture, as well as a program in undergraduate research participation, are available to selected students.

GENERAL POLICIES

REQUIRED FRESHMAN ENGLISH AND PHYSICAL EDUCATION

Each student is expected to schedule the required course in freshman English and the required freshman and sophomore courses in physical education every semester until these courses are passed satisfactorily.

WITHDRAWALS FROM THE UNIVERSITY

Students who wish to leave school during a semester or summer session must withdraw officially, initiating the process at the Counseling Center in Peele Hall. A student who completes a semester or summer session and does not plan to return need not officially withdraw.

CHANGES IN CURRICULA

Students may change from one curriculum to another by filing with the Office of Registration (at the time of registration) a curriculum change card signed by the dean or director of instruction concerned. Such changes are effective only at the beginning of a semester or summer session.

TUITION AND FEES

RESIDENCE STATUS FOR TUITION PAYMENT

The tuition charge for legal residents of North Carolina is less than for nonresidents. A legal resident of North Carolina is one who has his domicile in this State. It is important that each applicant for admission and each enrolled student know his residence status for tuition payment and understand the regulations governing residence status. The following regulations cover most factual situations:

1. A person 21 years of age or older is not deemed eligible for the lower tuition rate unless he has maintained his legal residence in North Carolina for at least the six months next preceding the date of his first enrollment in an institution of higher education in this State.

2. The legal residence of a person under 21 years of age at the time of his first enrollment in an institution of higher education in this State is that of his parents, surviving parent, or legal guardian. In cases where parents are divorced or legally separated, the legal residence of the father will control unless custody of the minor has been awarded by court order to the mother or to a legal guardian other than a parent. No claim of residence in North Carolina based upon residence of a guardian in North Carolina will be considered if either parent is still living unless the action of the court appointing the guardian antedates the student's first enrollment in a North Carolina institution of higher education by at least 12 months.

3. The residence status of any student is determined as of the time of his first enrollment in an institution of higher education in North Carolina and may not thereafter be changed except: (a) in the case of a non-resident minor student at the time of his first enrollment whose parents have subsequently established legal residence in North Carolina; and (b) in the case of a resident who abandons his legal residence in North Carolina. In either case, the appropriate tuition rate will become effective at the beginning of the semester or term next following the date of change of residence status.

4. The legal residence of a wife follows that of her husband, except that a woman student currently enrolled in this institution as a resident may continue as a resident even though she marry a nonresident.

5. Military personnel attached to military posts or reservations in North Carolina are not considered eligible for the lower tuition rate unless they have maintained a legal residence in the State for at least the six months next preceding the date of first enrollment in an institution of higher education in the State.

6. Aliens lawfully admitted to the United States for permanent residence who have established a legal residence in North Carolina according to Paragraphs number 1, 2, or 4 above, are eligible for the lower tuition rate.

7. Ownership of property in or payment of taxes to the State of North Carolina apart from legal residence will not qualify one for the lower tuition rate.

Discretion to adjust individual cases within the spirit of these regulations is lodged in the vice president and finance officer of the University.

Any student or prospective student in doubt concerning his residence status must bear the responsibility for securing a ruling by stating his case in writing to the director of admissions.

TUITION AND FEES

Charges for tuition and fees vary according to (1) the student's status as a resident or nonresident of North Carolina; (2) type of student (regular undergraduate, special or unclassified undergradu-

ate, auditor or graduate student); and (3) to a minor degree, the curriculum in which the student is enrolled.

An application for admission must be accompanied by an application fee of $10.

Tuition and fees are payable during the registration period. All charges are subject to change without notice, but the charges in effect currently are as follows:

Regular Undergraduate Students

Schools	In-State Students		Out-of-State Students	
	Fall Semester	Spring Semester	Fall Semester	Spring Semester
Agriculture and Life Sciences	$169.00	$168.00	$381.50	$380.50
Design	169.00	168.00	381.50	380.50
Education	169.00	168.00	381.50	380.50
Engineering	169.00	168.00	381.50	380.50
Forestry	179.00	168.00*	391.50	380.50*
Liberal Arts	169.00	168.00	381.50	380.50
Physical Sciences and Applied Mathematics	169.00	168.00	381.50	380.50
Textiles	169.00	168.00	381.50	380.50

* Add $10.00 if not registered in fall semester.

Late Registration

Registration schedules are set for specific days, and certain definite procedures are outlined. A student has not completed registration until all of the required steps are taken. All students, graduate and undergraduate, who fail to register on dates scheduled must pay a $5.00 late registration fee.

Undergraduate Students Taking Less Than Seven Hours

Undergraduate students taking one course of not more than four hours during a regular semester will be charged one-fourth tuition, one-fourth academic fees and no non-academic fees. These students will not be entitled to any of the services and privileges provided by the non-academic fees. Undergraduate students taking five or six hours during a regular semester will be charged one-half tuition, one-half academic fees and all non-academic fees. All other undergraduate students will pay full tuition and fees.

Audits

Subject to academic regulations, regularly enrolled graduate or undergraduate students may audit courses by registering for them. The first audit will be disregarded in determination of course load on which tuition and fee payments are based, but any additional audits are to be added to the course load at full credit hour value. Students

registered for audits only will pay the rates applicable to special unclassified students.

Unclassified Students

A student registering for course work as an unclassified student but requesting graduate credit will be charged the regular graduate student rate.

Graduate Students

Applicants interested in graduate work may receive a schedule of fees upon application to the Graduate School.

Commencement Fee

A fee of $9.00, covering cost of diploma and rental of cap and gown, is charged candidates for the baccalaureate degree during the last semester before the degree is awarded.

Deposits

(a) As partial security for library books, laboratory equipment, etc., a general deposit of $20 must be paid by regularly enrolled undergraduates and graduate students at the time of their first enrollment (see also under "Refunds").

(b) Certain departments are allowed to collect small deposits, in addition to the general deposit referred to above, for such things as lockers, etc. In such instances departmental regulations will apply.

Professional Students in Engineering

Students in the various fifth-year professional curricula will be charged on the same basis as undergraduate students.

Thesis Preparation

Graduate students who have completed course requirements and are in residence for thesis work only will be charged $15 per semester for tuition plus all fees. Graduate students not in residence who have completed all requirements for the degree sought, except for the thesis, will be required to register for the term in which final requirements for the degree are to be completed and pay a tuition fee of $15 and a $7.00 registration fee.

Degree Only

Graduate students who have completed all requirements for the degree sought are required to register for the term in which the degree will be awarded and pay a tuition fee of $10.

ROOM RENT

Rooms in University residence halls rent for $100 per semester for men and $135 for women. Room assignments are for the period of a school year and the rent is payable in advance prior to the beginning of each semester as announced. When a new student is accepted by the University, a letter of clearance is mailed to the student together with a room reservation request form. If a room is desired, the student should fill out the reservation request and return it with remittance to the Office of Business Affairs. Rooms will be assigned as long as space is available, in the order in which payment of rent is received. Individual preferences as to location of room and/or choice of roommate will be honored as far as possible. All reservations are subject to published residence hall rules and regulations.

Male freshmen are required to live in the University residence halls unless they are married, veterans, or living with parents or relatives. Each of these freshmen must make a written application to the director of student housing for permission to live outside the residence halls.

Undergraduate single women students not living with parents must reside in Watauga Hall unless authorized to live elsewhere by the director of student housing. Authorization to live off-campus will not be granted unless recommended by the advisor to women students at North Carolina State and approved by a parent.

Married Student Housing

University-owned apartments for married students rent for the following amounts:

Efficiency apartment	$43.00 per month
One-bedroom apartment	57.50 per month
Two-bedroom apartment	69.00 per month

For further information and application, write or visit the Housing Rental Office in Leazar Hall.

LAUNDRY

The University operates a modern laundry and dry cleaning facility on campus at reasonable prices. Branch offices are located in the residence halls for the convenience of the students.

LINEN AND BLANKET RENTAL SERVICE

The linen service provides for the initial issue of two sheets, one pillow case, and three towels. The student may exchange his linen weekly at a cost of $20 per year. Pillows may be rented for $1.50 per year. A regular blanket rents for $3 per year, and the N. C. State monogrammed blanket rents for $5. These services are available to

both campus and off-campus students. Application forms for these services will be mailed to incoming freshmen. Upperclassmen should apply to the office of Auxiliary Services in Room 207 Holladay Hall or the Housing Rental Office in Leazar Hall.

BOARD

Food service is provided at three conveniently located facilities, Leazar Cafeteria, Harris Cafeteria, and the Erdahl-Cloyd Union.

Cost depends on the individual's requirements and the selection of food. A typical student paying cash for each meal will spend approximately $2.20 a day or $500 for the academic year. Meal tickets are available at a 10 percent reduction. The 7-day-a-week board plan is available at approximately a one-third reduction, and the 5-day board plan, Monday through Friday, at approximately a one-fifth reduction from the cash prices of food. Under the board plan, the student is permitted to select any items from the menu on the cafeteria line within the established meal allowances, which are 55 cents for breakfast, 80 cents for lunch, and 85 cents for dinner. These plans provide for three wholesome, well-balanced meals per day and are available on a yearly, semester, or six weeks basis.

BOOKS AND SUPPLIES

The cost for books and supplies is variable, depending upon the curriculum in which the student is enrolled. A reasonable estimate is $100 per year, but students who require drawing supplies and slide rules have an additional original outlay. All books and supplies must be paid for in cash as purchased.

ESTIMATED ANNUAL COST

(Items such as tuition, fees, and room rent in residence halls are fixed costs. Other items are variable with the individual student.)

Tuition (Non-resident students add $212.50 per semester	*Fall Semester*	*Spring Semester*	*Annual Total*
	$ 87.50	$ 87.50	$ 175.00
Other University fees	81.50	80.50	162.00
General deposit (paid at first enrollment only)	20.00		20.00
Residence hall room (men)	100.00	100.00	200.00
Residence hall room (women)	135.00	135.00	270.00
Linen service (optional)	20.00		20.00
Board	175.00-250.00	175.00-250.00	350.00-500.00
Books and supplies	50.00-100.00	25.00	75.00-125.00
Personal expenses and incidentals	100.00-150.00	100.00-150.00	200.00-300.00
Total (N.C. residents)	$634.00-809.00	$568.00-693.00	$1,202.00-1,502.00
Total (non-residents)	$846.50-1,021.50	$780,50-905.50	$1,627.00-1,927.00

REFUNDS

Tuition and Fees

A student who withdraws from school on or before the last day for registration will receive a refund of the full amount paid, less a $7.00 registration fee. On withdrawal later than the period specified, no refund will be made.

Room Rent

Refund of room rent will be made as follows, if reservation is cancelled (subject to change as rates increase):

a. Prior to the first day of the registration period, the rent paid will be refunded less a $10 reservation fee.

b. During the registration period, the rent paid will be refunded less a $10 reservation fee or a charge of $1.00 per day (whichever amount is greater) from the first day of the registration period (or date of reservation, whichever is later) to date of cancellation.

c. After the last day for registration, no refund will be made for any reason other than withdrawal from school.

Cancellation of reservations must be made in person or in writing to:

Housing Rental Office
Leazar Hall
North Carolina State
Raleigh, North Carolina

Linen Rental

Refunds under the linen rental plan are computed on a semester basis. During a semester refunds will be computed at a charge rate of 65 cents for each week the plan has been in use, plus a $2 service charge until $10 is exhausted. Refunds are not available for the weeks a student fails to exchange linen. During the year withdrawals, turn-in of linen, and computation of refunds will be accomplished at the University Laundry.

General Deposit

Miscellaneous charges for laboratory breakage, traffic fines, residence hall and property repair charges, military property charges, physical education equipment charges, and all other miscellaneous charges will be deducted from the general deposit of $20, as incurred throughout the year. The $20 general deposit must be rebuilt to the $20 level by the student whenever the deposit has been depleted to or below the $5 level.

The general deposit of $20 or the remaining balance is refunded when a student has completed the requirements for a degree or has

permanently withdrawn from the University. The student must apply to the Office of Business Affairs for the refund, at which time a correct mailing address must be given. Refund will be made by check approximately 30 days from the date the application is received.

Refund Committee

In some instances circumstances justify the waiving of rules regarding refunds. An example might be withdrawal from the University because of illness. Students have the privilege of appeal to the Refund Committee when they feel that special consideration is merited. Applications for such appeals may be secured from the Division of Student Affairs.

STUDENT ACTIVITIES AND SERVICES

North Carolina State makes every effort to provide the student with surroundings which are pleasant and conducive to intellectual growth. Respecting the student as an individual, the University assures him the maximum of personal liberty within the limits necessary for orderly progression of class work. In return, he is expected to pay serious attention to his purpose in attending college and to observe rules of conduct consistent with maturity. Through the various services and activities identified with everyday life on the campus, as well as through the several extra-curricular organizations and functions, the student at State has an excellent opportunity for acquiring experience in group leadership and community living which may serve him well in his professional career.

As the student progresses in his development, especially after his freshman year, he will find many opportunities to increase his growth in citizenship by participating in the activities of his academic class and of the student body in general. Following is a survey of the various activities at North Carolina State.

STUDENT GOVERNMENT AND HONOR SYSTEM

When a student enters North Carolina State, he becomes a member of a self-governing community.

Legislative, executive, and judicial authority, insofar as student affairs are concerned, rest with the Student Government which operates within the framework of over-all University administration. The Student Government members and Judicial Department members are elected in campus-wide elections. The student has a voice in his own government by participating in these elections. Often in general elections he is asked to vote on proposed changes in regulations which affect the student body.

The student also becomes part of the Honor System. He is expected to adhere to its general aims, which are honesty in class work and honor in general conduct.

CLUBS AND SOCIETIES

Through the various honorary, professional, technical, and social organizations at North Carolina State, the interested student finds

many opportunities to participate in activities that appeal to him, and to meet others who have similar interests.

UNIVERSITY HONORARY

Honorary societies and fraternities at North Carolina State are Golden Chain, senior leadership; Blue Key, junior leadership; Thirty and Three, sophomore leadership; Phi Eta Sigma, freshman scholarship; and Phi Kappa Phi, junior, senior, and graduate student scholarship.

PROFESSIONAL AND TECHNICAL

Each school at North Carolina State sponsors or supervises a large number of professional and technical societies and clubs. Students in every area of instruction are encouraged to join with their fellow students in pursuing their common interests. Many of these organizations contribute greatly to the student's professional and social growth.

SOCIAL FRATERNITIES

Seventeen national social fraternities have chapters at State. Each sends two representatives to the Interfraternity Council, which has as its objectives promoting the general interests and welfare of the associated fraternities and insuring cooperation among them and the faculty, the student body, and the general public. All fraternities have resident housemothers who assist in preparing meals and planning social functions and act as hostesses.

The social fraternities are Alpha Gamma Rho, Delta Sigma Phi, FarmHouse, Kappa Alpha, Kappa Sigma, Lambda Chi Alpha, Phi Kappa Tau, Pi Kappa Alpha, Pi Kappa Phi, Sigma Alpha Epsilon, Sigma Alpha Mu, Sigma Chi, Sigma Nu, Sigma Phi Epsilon, Sigma Pi, Tau Kappa Epsilon, and Theta Chi.

State has one national social sorority, Sigma Kappa.

STUDENT PUBLICATIONS

A variety of publications, both general and school-sponsored, are edited and managed by student officers, with faculty members serving as advisors. A student may gain journalistic experience and training in writing, editing, or management by working on these publications.

The three general publications, *The Agromeck,* The Student Broadcasting System, WKNC, and *The Technician,* are supported in large part by a publication fee included in each student's fees.

THE AGROMECK

The Agromeck is the University yearbook, providing a record of the senior class and of the principal events of the school year. The year-

book recalls in pictures the varied activities of the student body throughout the year, and is published for the entire student body.

THE TECHNICIAN

The Technician is the student newspaper issued three mornings a week and delivered to central locations on the campus, such as the Coliseum, cafeterias, classroom buildings, and the Student Supply Store. *The Technician* serves as a forum for student expression as well as a medium for campus news of particular interest to State students.

THE STUDENT BROADCASTING SYSTEM—WKNC

Although it is not a publication in the strictest sense of the word, WKNC (at 600 KC), a carrier-current station with coverage limited to the campus, serves the same function through a different medium. It offers many opportunities for extra-curricular training in actual broadcasting techniques as well as training in administration and program planning.

THE TOWER

Each student receives a copy of *The Tower*, the University handbook, which contains detailed information about student regulations, organizations, and activities.

OTHER PUBLICATIONS

Several of the schools have their own publications issued under the general supervision of the particular school and dealing with material of special interest to students in that school. These publications include *The Ag Student*, published by the School of Agriculture and Life Sciences, *The Pi-ne-tum*, published by the School of Forestry; *The Southern Engineer*, published by the School of Engineering; *The Textile Forum*, published by the School of Textiles; the *Publications* of the School of Design; and *The Scientist*, published by the School of Physical Sciences and Applied Mathematics.

ATHLETICS

In addition to voluntary programs of intramural and intercollegiate sports, State requires freshmen and sophomores to enroll in credit courses in physical education. Juniors and seniors may take physical education as an elective.

INTRAMURAL

The University maintains an extensive program of intramural sports, administered by the Department of Physical Education. Par-

ticipation in these sports is purely voluntary and college credit is not given. Competition is divided into three divisions: Residence Halls, Fraternity, and Open. Thirteen sports are offered in the residence halls and fraternity divisions, and four sports plus special events in the open division.

Sports offered in the intramural program are correlated with those taught in the required programs of physical education. Instruction in these sports is given in the classes and opportunity for competition is provided in the intramural program. An Intramural Advisory Board, composed of student representatives and one physical education staff member, determines the policies to be administered by the intramural director.

The intramural facilities, both indoor and outdoor, are excellent. The intramural playing fields, adjacent to the gymnasium, provide space for ten softball or ten football games to be played simultaneously. Twenty tennis courts are available, and construction of additional courts is being considered.

The gymnasium has ten four-wall handball courts, six squash courts, and separate rooms for boxing, wrestling, golf, correctives and weightlifting. The main gymnasium floor provides seven basketball courts which may be adjusted to accommodate eight volleyball courts, twenty badminton courts, indoor tennis and various other sports. This space also includes a gymnastic area greater than the size of a regulation basketball court.

The swimming pool, located in an adjoining building, is twenty-five meters by twenty-five yards and has two one-meter and one three-meter diving boards.

INTERCOLLEGIATE

Intercollegiate athletics at North Carolina State come under the supervision of a separate department of the institution. Policies governing intercollegiate competition are recommended, however, by the Athletic Council which is composed of faculty, students, and alumni. The policies are in full accord with the Atlantic Coast Conference and N.C.A.A. rules of eligibility for intercollegiate contests. Membership of the Atlantic Coast Conference includes—in addition to State—Duke University, Wake Forest College, the University of North Carolina at Chapel Hill, the University of Maryland, Clemson University, the University of South Carolina, and the University of Virginia.

The program in intercollegiate athletics consists of the organization and training of "Wolfpack" teams in football, basketball, baseball, track, cross country, wrestling, swimming, tennis, golf, soccer, and rifle competition.

Facilities for intercollegiate athletics at State include Riddick Stadium, a 20,000-seat stadium for football; William Neal Reynolds Coliseum, a 12,500-seat arena for basketball; football practice fields; tennis courts; a swimming pool of olympic dimensions; a gymnasium; a baseball field; and facilities in the Coliseum for wrestling and other sports.

MUSIC

Since the early days of North Carolina State, musical organizations have played an important part in the life of the campus. These groups present concerts, furnish music for official University functions, and perform at athletic events. Rehearsal schedules have been carefully arranged to avoid conflicts with other classes or with study time. The combined membership of these organizations constitutes the largest voluntary student organization on campus.

THE MEN'S GLEE CLUB

The Varsity Men's Glee Club and the Collegiate Men's Glee Club comprise the two sections of the North Carolina State Men's Glee Clubs. Placement in a glee club is made according to the interests and abilities of the individual student. Students not able to meet the requirements of the Varsity Men's Glee Club are eligible to try for the Collegiate Men's Glee Club.

Both organizations present concerts on and off campus throughout the year and combine for special programs. Radio and television appearances, recordings, tours and providing small ensembles for special occasions are additional activities.

BANDS

The Symphonic Band, the Fanfare Band, the Marching Band, and the ROTC Band make up the four divisions of the North Carolina State Bands. Each band serves a specific purpose in the musical life on the campus. Assignments to the various bands are made according to the interests and ability of the individual student.

The Symphonic and Fanfare Bands are concert organizations. Students who are unable to meet the rigid requirements for the Symphonic Band are eligible to try for the Fanfare Band.

The Marching Band operates primarily during football season and is widely known for its spectacular half-time performances.

The ROTC Band consists of freshmen and sophmore ROTC and AFROTC students. Participation in band excuses the student from all ROTC drill on the field.

THE WOMEN'S CHORUS

The Women's Chorus presents several concerts each year both on and off campus. The performance of the best musical selections for women's voices, social, educational, and recreational advantages are among the chief objectives of the Chorus. Membership is open to all coeds on campus who are interested in singing.

Additional information concerning musical activities may be obtained by writing or visiting the director of music in Pullen Hall.

STUDENT CENTERS

Three important centers for the extra-curricular activities of State students are the Erdahl-Cloyd Union, the E. S. King Religious Center, and the International Student Center.

ERDAHL-CLOYD UNION

The Erdahl-Cloyd Union building is not only the center for an extensive social and cultural program, but also provides facilities for recreation and relaxation. In addition to a snack bar, dining room, barber shop and ballroom, there are meeting rooms, a library and lounge area, a gallery area for exhibits, music listening room, guest rooms and a games room. The offices of the Union and other organizations are located on the second floor. The Union operates a theatre and craft shop in the Frank Thompson building.

The purpose of the Union is to provide a facility and a program which will complement the academic life of the student and offer him an opportunity to further already existing interests and to develop new ones. Many of the programs at the Union are organized and executed by students. Everyone is encouraged to participate in some aspect of the Union's activities.

E. S. KING RELIGIOUS CENTER

In addition to the functions and activities held in the Erdahl-Cloyd Union, many other activities—especially those of a religious, spiritual and devotional nature—are held within the E. S. King Religious Center. The Center has an attractive lobby equipped with writing and reading tables and chairs, a television room, and four conference rooms where student and faculty groups may meet. The coordinator of religious affairs and several denominational chaplains have their offices in this building.

The Danforth Chapel, located in the Center, provides a place for religious services and meditation for students of all faiths.

The E. S. King Religious Center plans social events and lectures on various topics related to student life in addition to, or in connection with, its programs of religious emphasis.

INTERNATIONAL STUDENT CENTER

The International Student Center, located in the basement of the King Religious Building, is provided primarily for the relaxation and recreation of international students. The Center provides a television lounge and small kitchen for student use. The office of the director of the International Student Center is located on the same floor. The director serves as a counselor and advisor to international students.

HOUSING, FOOD, LAUNDRY AND LINEN SERVICES

HOUSING

North Carolina State began a residence hall building program some 63 years ago, primarily to provide students with suitable University buildings in which to live and study. Today, however, the responsibilities of student housing are considered to be something more. Today the mission of the Department of Student Housing is to provide the very best facilities possible for residents at the lowest cost. This includes the provision of adequate and satisfactory facilities, appropriate activities and programs, and residence supervision. Residence halls are supervised by counselors employed by the Department of Student Housing to assist residents, develop and maintain satisfactory study conditions, enforce University regulations, and insure proper use of University facilities.

University residence hall housing regulations are posted in each room. It is the occupant's responsibility to read and comply with these regulations. Failure to do so may result in extra charges and disciplinary action.

Residence Hall Accommodations—Men

In the eight larger residence halls, faculty or graduate couples serve as head residence counselors. They assist the occupants with their problems and provide a pleasant atmosphere in which parents and friends may visit the residence halls. Each residence hall has a residence counselor, an upperclassman with the qualifications for, and the responsibility of, helping the individual student—particularly freshmen—in any way that he can. Floor counselors and assistant floor counselors, chosen on the same basis, assist the residence counselor. Whenever these counselors cannot answer particular questions or give aid in solving special problems, they direct the student to the appropriate administrative official.

A well organized residence hall program plays an important role in the student's all-round development. Each residence hall annually elects officers during the spring semester to serve for the next academic year. The president and vice-president of each residence hall serve as representatives on the Inter-Dormitory Council, the student organization which coordinates inter-dormitory activities and programs.

Students are encouraged to participate in the athletic, social and recreational activities of the residence hall. Participation in these activities provides an opportunity for the student to meet and make friends with students of varied backgrounds, to use his leisure time pleasantly and profitably, and to grow in personality. Athletic directors are appointed by the Department of Student Housing to encourage and maintain participation in the athletic and recreational activities.

Residence Hall Accommodations—Women

North Carolina State has one residence hall for 90 women students. Single undergraduate women are given priority for assignment to Watauga Hall. A head residence counselor (housemother) is employed in the women's residence hall. Available off-campus facilities are also listed in the Housing Rental Office in Leazar Hall for graduate and other women who cannot get an assignment in Watauga Hall.

Married Student Housing

For married students, the University has for rent 300 permanent efficiency, one and two-bedroom apartments. Priority for assignment goes to graduate students first, veterans eligible for government educational benefits, second, and all other married students, third.

Fraternities

During 1963-64 approximately 600 students were housed in 12 new on-campus and 5 off-campus fraternity houses maintained by social fraternities having chapters at North Carolina State. Each fraternity is represented on the Inter-Fraternity Council which sponsors athletic events and social functions of particular interest to fraternity members.

FOOD SERVICE

The North Carolina State student does not have to travel far for food, whether for a full meal or a snack.

Food service is provided in three conveniently located facilities. In addition to two campus cafeterias, the Erdahl-Cloyd Union offers regular meals and maintains an excellent snack bar.

Cost depends a great deal upon the selection of food. The typical student, paying cash for each meal, will spend approximately $2.20 a day or $500 for the year. Meal tickets are available at a 10 percent reduction. The seven day per week board plan is available at approximately one-third reduction and the five day plan is available at one-fifth reduction from the cash price of food. Under the seven day board plan the student may purchase meals regularly priced at $2.20 for $1.43 per day or $330 per year and may select any available items. This provides for three wholesome well balanced meals per day. These plans are available on yearly, semester, or six weeks basis.

Snack Bars

Each residence hall area has its own snack bar operated by the Student Supply Store system.

LAUNDRY AND DRY CLEANING

The University laundry provides on-campus laundry and dry cleaning service on a cash-and-carry basis for students and staff. The rates are inexpensive.

BOOKS AND SUPPLIES

STUDENT SUPPLY STORE

North Carolina State's ultra-modern Student Supply Store, located on Dunn Avenue, houses an excellent book department, general student supplies, engineering equipment, and a fountain-snack bar.

BOOK EXCHANGE

Alpha Zeta, student honor fraternity, maintains a book exchange in the Erdahl-Cloyd Union where students may exchange or sell used books.

HEALTH

INFIRMARY

North Carolina State seeks to safeguard the health of the student in every way possible. The University maintains a 76-bed infirmary which is open 24 hours a day. The seventeen staff members include physicians, a supervising nurse, a night supervisor, six general duty nurses, one full-time laboratory and X-ray technician, and five other employees. Among the many valuable features of the infirmary are an up-to-date first aid department and X-ray department.

The University physicians observe regular daily office hours at the infirmary in the mornings and afternoons. In addition, they visit the infirmary more often when necessary. A graduate nurse is on duty day and night. Students have free access to the infirmary at all times.

In case of accident or the serious illness of a student, parents or guardians will be notified immediately. No surgical operation will be performed without full consent of parents or guardians, except in cases of extreme emergency.

The medical fee paid by each student provides for infirmary service, general medical treatment, and the services of nurses. It does not provide for surgical operations, outside hospital care, or the services of dentists or other specialists.

Before the student enters North Carolina State he should have a complete, thorough examination by his family physician. Any abnormality should be noted and all defects corrected in order to prevent unnecessary loss of time while the student is in college. If the examination is not made before he enters, the student will be given a physical examination at the University, for which a fee is charged. Blanks for the physical examination may be secured from the Office of Admissions and Registration.

ACCIDENT AND HEALTH INSURANCE

The University offers annually a plan of student accident and health insurance. The insurance is planned to cover the surgical, accident

and hospital needs of the student, as a supplement to the services offered through the infirmary. Each year complete information will be made available to students before the opening of school.

Foreign students are required to enroll in the sickness and accident insurance plan provided through the University or to have similar coverage under other insurance plans or arrangements with their sponsors.

ORIENTATION

Several days before the registration of upperclassmen in the fall semester, new students arrive on the campus for a series of activities planned during Orientation Week. To help freshmen with the transition from high school to college and to help new students become acquainted with the campus and with various regulations, the University arranges during this period a series of meetings and conferences with faculty and student leaders.

Throughout the first semester, there are other activities designed to continue orientation and to supplement orientation courses conducted by the individual schools. In addition, the individual schools provide for regular contact with faculty advisors in order that each student may have the opportunity of discussing matters connected with his adjustment to college life.

COUNSELING: STUDENT QUESTIONS AND PROBLEMS

The main source of general information for students is the Division of Student Affairs, which includes the various administrators handling admissions, registration, records, student activities, student housing, orientation and counseling, and student financial aid.

ACADEMIC ADVISING

Upon enrolling at State, each student is assigned a faculty advisor, usually a member of the department in which the student is taking his major work. This faculty advisor works with the student in planning his program of studies and is available for assistance in solving problems of an academic nature. The deans, directors of instruction, and department heads are also available to the student to help provide information about the different curricula and to assist with long-range curricular or career planning. Teachers of courses in which the student is enrolled are the best sources of help with particular subjects. Members of the teaching staff maintain a schedule of office hours and expect the student to consult them individually whenever special help is needed.

DORMITORY COUNSELING

As described in the section on Housing, student residents and floor counselors, and the head residents (faculty and graduate couples) assigned to the larger dormitories, provide assistance with various questions and problems.

COUNSELING CENTER

The Counseling Center has a staff of full-time counselors to help students with problems of vocational and curricular choice, and personal adjustment. The Center is prepared to administer various aptitude and interest tests and maintains a file of occupational information. Referral can be made for students desiring remedial work in speech, reading, and other special areas. Students may come to the Center on their own initiative or may be referred by teachers, advisors, or other members of the college staff. There is no cost to the student for conferences but a small materials fee is charged when tests are administered.

PLACEMENT

Each of the degree-granting schools at North Carolina State provides its students with assistance in obtaining employment during summer vacations and upon graduation. In some curricula a period of approved summer work is required for graduation.

FINANCIAL AID

Help in meeting college expenses is available to students in several forms. Financial aid is administered by the Financial Aid Officer under the general direction of the Committee on Scholarships and Student Aid. Students seeking information or counseling on financial matters, or wishing to apply for assistance, should write or visit the Financial Aid Office in Peele Hall.

SCHOLARSHIPS, GRANTS-IN-AID, LOANS

Entering freshmen seeking financial aid should so indicate on their applications for admission and thus participate in the annual Talent-For-Service Program. They should obtain Parents' Confidential Statement forms from their respective high schools and have their parents complete the forms and submit them to the College Scholarship Service in Princeton, New Jersey, before February 1 of the year preceding expected fall enrollment. The Financial Aid Office at North Carolina State then receives from the College Scholarship Service a financial need analysis report for each applicant, which helps determine how much financial aid will be offered.

Awards are made to freshmen, considered in need of help, who show

strong promise of academic success as indicated by their high school records and their entrance test scores. These awards usually offer combinations of scholarship and loan help, or loans only, depending upon the degree of need. Out-of-state candidates are usually offered only loans for the first year. Freshmen who do not meet the requirements for aid on first enrollment will, if need is evident, become eligible for such help upon satisfactory completion of one semester or more of study at North Carolina State.

Upperclassmen ordinarily must apply for financial aid each year. By one application each student receives consideration for all available scholarships for which he is eligible, as well as for a loan to make up the total amount of help needed. Each recipient must have a satisfactory record of academic achievement and citizenship.

North Carolina State participates in the National Defense Student Loan Program under which loans draw no interest until one year after the student leaves college. Most student loans are made from this source. Loans from other funds are made on slightly different terms. Repayments of all long-term loans begin after graduation or withdrawal from the University.

Emergency loans are available to meet unforeseen expenses. These loans must be repaid in 30 to 60 days and are not extended beyond the end of a term or graduation.

Another source of help, particularly for entering freshmen who do not qualify for direct help from the University, is the College Foundation, Inc., of Raleigh. Loans in approved amounts up to $500 a year for students recommended by the University bear interest at 5 percent from the date of execution of the note, but with no principal or interest payments expected while the student is enrolled in college. Application is initiated through the Financial Aid Office.

GRADUATE FELLOWSHIPS

Graduate Fellowships are funds offered to graduate students to assist in the support of programs of advanced study. Holders of fellowships have no obligations to the University and may devote full time to the prosecution of their graduate programs. Funds for these fellowships are provided by various government agencies, professional groups, and business organizations. Applicants for fellowships should contact the head of the department in which they wish to pursue studies

GRADUATE ASSISTANTSHIPS

Graduate Assistantships are short-term staff appointments that carry stipends ranging from $1,200 to $4,800 depending upon the magnitude of the service obligation and the experience of the appointee. Teaching assistants are customarily appointed annually for the nine-month academic year. Research assistants are often appointed on a calendar year basis and, accordingly, stipends may be 20 per cent larger than those for teaching assistants. Only graduate students

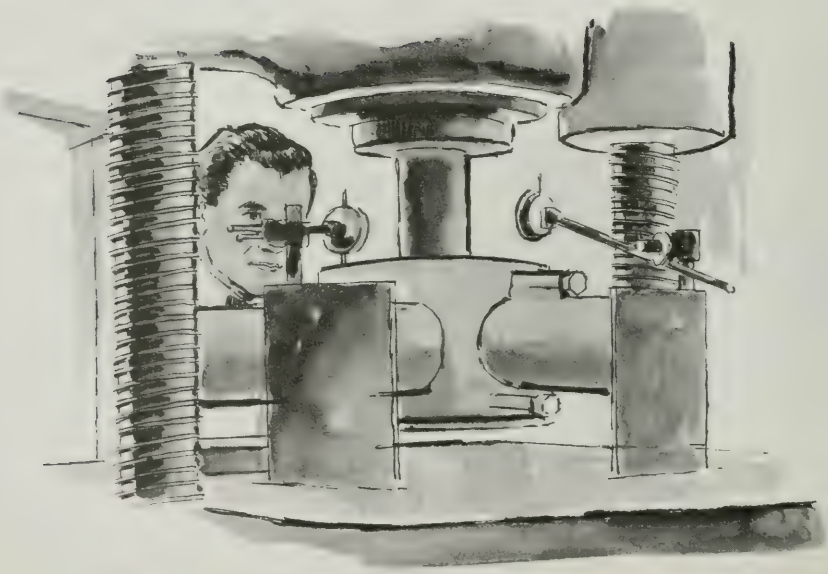
in good standing are eligible for appointment to graduate assistantships. The course loads permitted graduate assistants are adjusted in proportion to the service obligation. Graduate assistants giving half-time to their service obligation may register for 60 percent of a full course load.

ATHLETIC AWARDS

Athletic Awards are made upon the recommendation of the Athletic Department to athletes who meet the established qualifications for such awards.

PART-TIME EMPLOYMENT

A Part-time Employment Service is provided to assist students in locating jobs both on and off campus. Students who desire part-time work should call at the Financial Aid Office when they arrive on the campus.



SCHOOLS AND PROGRAMS OF STUDY

There are eight major undergraduate academic divisions at North Carolina State. These are the Schools of Agriculture and Life Sciences, Design, Education, Engineering, Liberal Arts, Forestry, Physical Sciences and Applied Mathematics, and Textiles. Each of the schools is administered by a dean. The programs of study are outlined by school. Additional information concerning specific courses may be found in the section of the catalog on course descriptions.

In addition to information on the schools, this section contains brief descriptions of the military training program (ROTC), the Graduate School, and the Division of General Extension.

Throughout the programs of study given in this section, departmental codes, course numbers and course titles are used. The key to the departmental code is listed below. This key will also aid in locating individual course descriptions.

CODE	NAME
AG	Agricultural Communications (see Agriculture)
AC	Agriculture
AGC	Agricultural Economics
AGE	Agricultural Engineering
AL	Agriculture and Life Sciences
ANS	Animal Science
ANT	Anthropology
ARC	Architecture
ART	Art
AS	Air Science
BO	Botany and Bacteriology
BS	Biological Science
CE	Civil Engineering
CH	Chemistry
CHE	Chemical Engineering
CS	Crop Science
DN	Design
E	Engineering
EC	Economics

CODE	NAME
*ED	Education (general courses)
EE	Electrical Engineering
EH	Engineering Honors
EM	Engineering Mechanics
ENG	English
ENT	Entomology
EPD	Extension Personnel Development
FOR	Forestry
FS	Food Science
GN	Genetics
HI	History
HS	Horticultural Science
IA	Industrial Arts
IE	Industrial Engineering
ISO	International Student Orientation
LAR	Landscape Architecture
LBA	Liberal Arts
MA	Mathematics
ME	Mechanical Engineering
MIC	Mineral Industries—Ceramic Engineering
MIG	Mineral Industries—Geological Engineering
MIM	Mineral Industries—Metallurgical Engineering
ML	Modern Languages (general courses)
MLE	Modern Languages (English for foreign students)
MLF	Modern Languages (French)
MLG	Modern Languages (German)
MLI	Modern Languages (Italian)
MLR	Modern Languages (Russian)
MLS	Modern Languages (Spanish)
MS	Military Science
MUS	Music
NE	Nuclear Engineering
PD	Product Design
PE	Physical Education
PHI	Philosophy
PO	Poultry Science
PP	Plant Pathology
PS	Political Science

* Also, Agricultural Education courses, a few Industrial Arts courses, Industrial Education courses, Mathematics and Science courses, and Occupational Information and Guidance courses.

CODE	NAME
PSM	Physical Sciences and Applied Mathematics
PSY	Psychology
PY	Physics
REL	Religion
RPA	Recreation and Park Administration
RS	Rural Sociology
SOC	Sociology
SS	Social Studies
SSC	Soil Science
ST	Experimental Statistics
TC	Textile Chemistry
TX	Textiles, Textile Technology, Knitting Technology, and general courses
ZO	Zoology

SCHOOL OF AGRICULTURE AND LIFE SCIENCES

H. BROOKS JAMES, *Dean*

EDWARD W. GLAZENER, *Director of Instruction*

The agriculture of today's world consists of much more than the growing of food and fiber. Encompassed within the broad concept of agriculture are the technical, professional and business occupations related to the processing and distributing of farm goods. In addition, increasing our knowledge of the life processes of plants and animals constitutes a major concern of the School of Agriculture and Life Sciences.

Today, approximately one third of all the gainfully employed persons in the United States are in occupations that are directly or indirectly related to agriculture. For example, these would include those persons who produce and supply the many complex needs which the farmer has, the farmer himself, those to whom he sells, the processor of these products as well as the retailer. There are more than 500 distinct occupations in today's agriculture—jobs that each year need more than twice the number of people trained to fill them.

FACILITIES

A sound teaching and research program is based on taking advantage of the most modern equipment available in each field. North

Carolina State is fortunate to have at its disposal the newest equipment and facilities in many fields.

Laboratories are well equipped with the necessary materials for learning and practicing the basic and applied sciences. Machinery and equipment, in some cases provided by private industry, keep students abreast of the latest technological advances. Extensive plant, animal and insect collections are available for use in teaching and for research.

The D. H. Hill Library at North Carolina State has a large collection of scientific books and periodicals which provides excellent source material for many courses. In addition, students may draw from the specialized periodicals and textbooks located in the department libraries.

The University's 16 outlying research farms provide a practical classroom for many courses, as well as a place where researchers can carry on basic and applied research.

STUDENT ACTIVITIES

Students in the School of Agriculture and Life Sciences have ample opportunities to take part in many broadening extra-curricular activities, both within the School and in the University itself.

Most departments have student organizations which provide professional as well as social experience. Student tours provide an opportunity to see first-hand the application of classroom principles.

In addition, judging teams representing animal science, horticultural science, food science, poultry science and soil science compete regionally and nationally, providing student members a chance to travel while learning more about their field.

CURRICULAR OFFERINGS AND REQUIREMENTS

The modern concept in agriculture and biology has given North Carolina State's oldest school its newest look.

A freshman enrolling in the School of Agriculture and Life Sciences now chooses from four curricula—*agricultural business, agricultural science, agricultural technology* or *biological sciences*—devised to more closely parallel the new concept.

After completing the first two years, consisting largely of basic courses in the biological, physical and social sciences, the student can choose his major from among the 15 departments.

The student's needs for learning "how to make a living" and for learning "how to live" are both given consideration in the four curricula. Not only does each student get the solid background in science so necessary for the technical age in agriculture and biology, but he also has a chance to develop a program to fit his individual needs.

Although requirements vary in the curricula, students in all four have requirements in English, the social sciences and humanities, and the physical and biological sciences. In addition, electives can be chosen from several specified areas (see curricula listing below),

depending on the curriculum. The student also has departmental requirements and electives in his major field.

In general, requirements are similar no matter which broad area of specialization the student chooses. However, the program in science places more emphasis on the physical and biological sciences, while that in business emphasizes economics and business management, and the course in technology is stronger in the applied science and technology courses. The biological sciences curriculum places stress on the life processes as they relate to plants and animals.

The majors offered in the four curricula are as follows:

Agricultural Business—agricultural economics, animal science, crop science, food science, horticultural science, poultry science and soil science.

Agricultural Science—agricultural economics, agricultural engineering (joint program with the School of Engineering), animal science, botany, crop science, food science, entomology, horticultural science, plant protection, poultry science, rural sociology, soil science, wildlife biology and zoology. Pre-veterinary work also is taken in this curriculum.

Agricultural Technology—agricultural engineering, animal science, crop science, food science, horticultural science, poultry science and soil science.

Biological Sciences—This curriculum emphasizes the basic biological and physical sciences on a non-departmental, broad spectrum, especially designed as preparatory for graduate study or educational or teaching careers in biology.

DEGREES

The degree of Bachelor of Science is conferred upon the satisfactory completion of one of the curricula in this school.

The degrees of Master of Science, Master of Agriculture and professional degrees are offered in the various departments of the School of Agriculture and Life Sciences after the satisfactory completion of at least one year of graduate study in residence.

The Doctor of Philosophy degree is offered by the following departments: Agricultural Economics, Agricultural Engineering, Animal Science, Crop Science, Botany and Bacteriology, Entomology, Food Science, Genetics, Plant Pathology, Rural Sociology, Soil Science and Zoology.

Further information on graduate offerings may be found in the Graduate School Catalog.

OPPORTUNITIES

Agriculture is a broad field with fascinating new opportunities. It needs trained persons to process and distribute agricultural products, to give special services to people who actually produce these products, and to do research and teaching that will make our agricultural production and distribution even more efficient.

The eight major fields of agriculture—research, industry, business, education, communications, conservation, service areas, and farming and ranching—provide many distinct opportunities. Graduates are in much demand.

In North Carolina there is a great need for college-trained specialists in the fertilizer, dairy, feed, insecticide, farm implement and distribution industries. These industries use graduates in key positions.

Some of the opportunities in the broad areas of *agriculture* are as follows:

Research—production, marketing, engineering processing, conservation, reclamation.

Industry—machinery and equipment, chemicals, fertilizer, feed manufacturing, seed processing, food processing, meat and poultry packing.

Business—banking and credit, insurance, farm management, cooperatives, land appraisal, marketing, transportation.

Education—vocational agriculture, agricultural extension, college instruction, governmental agencies.

Communications—writing, reporting, radio, television, newspapers, magazines, advertising, publications.

Conservation—soil, water, range, forest, fish, wildlife, parks, turf.

Services—inspection and regulation, production field service, quality control and grading, agricultural technology and consulting.

Farming and ranching—general, dairy, swine, beef, sheep, poultry, cotton, forage, grain, fruits, tobacco, vegetables.

Opportunities for the *biological sciences:*

Preparation for graduate and medical schools and for educational careers in biology.

INTERNATIONAL OPTION

Recognizing the increasing importance of training students to work in countries outside the United States, the School has selected a series of courses designed to aid those students desiring an appreciation or an orientation for foreign assignments. These courses may be chosen from electives within the major curriculum of the student, thereby not increasing the number of required course credits. In addition to appropriate foreign language courses, the student may take 12 or more hours in such courses as comparative governmental systems, cultural anthropology, economic development in emerging countries and the like. Such courses, besides the training in some phase of agriculture, prepare the student on a very broad basis for immediate or future consideration of a foreign assignment.

Also, an exchange program has been established between North Carolina State and the University of Puerto Rico, providing an opportunity for one year of study for the student interested in tropical agriculture.

Practically all types of occupations, more than 500 of them, are available to a graduate in this School. There are many opportunities in biology, technology, agricultural science, business and life processes.

The School of Agriculture and Life Sciences stands ready to help meet the challenge of modern concepts with forward-looking curricula.

FRESHMAN YEAR

(The departments in the School of Agriculture and Life Sciences have a common freshman year with the exception of the science program in the Department of Agricultural Engineering. For the agricultural science, agricultural engineering freshman year see Department of Agricultural Engineering.)

Fall Semester	*Credits*
AG 103 Orientation	1
ENG 111 Composition	3
MA 111 Algebra and Trigonometry	4
HI 261 U. S. in Western Civilization	3
BS 100 General Biology	4
Physical Education	1
Military Science	
or	
Air Science	1
	17

Spring Semester	*Credits*
ENG 112 Composition	3
MA 112 Analytic Geometry and Calculus A	
or	
MA 102 Analytic Geometry and Calculus I	4
PS 201 American Governmental System	3
Elective	4
Physical Education	1
Military Science	
or	
Air Science	1
	16

CURRICULA IN THE SCHOOL OF AGRICULTURE AND LIFE SCIENCES

Curriculum in Agricultural Business

	Credits
AG 103 Orientation	1
Languages (12 Credits)	
ENG 111, 112 English Composition	6
ENG 231 Basic Speaking Skills	3
Elective (English or Modern Language)	3
Social Sciences and Humanities (21 Credits)	
EC 201 Economics	3
AGC 212 Economics of Agriculture	3
HI 261 The United States in Western Civilization	3
PS 201 The American Governmental System	3
PSY 200 Introduction to Psychology	3
RS 301 Sociology of Rural Life	3
Elective from Group D	3
Physical and Biological Sciences (25 Credits)	
MA 111, 112 Algebra and Trigonometry, Analytic Geometry and Calculus A	8
CH 101 General Chemistry I	4
PY 221 College Physics	5
BS 100 General Biology	4
Biological Sciences Elective	4
Electives (67 Credits) *	
Restricted electives from Group B	24
Restricted electives from Groups A and C	5
Departmental requirements and electives	26
Free electives	12
Sub-total	126
Physical Education	4
Military Science	
or	
Air Science	4
Total	134

* Group A includes the physical and biological sciences; Group B, economics and business management; Group C, applied science and technology; Group D, social sciences and humanities.

Curriculum in Agricultural Science

	Credits
AG 103 Orientation	1
Languages (12 Credits)	
Eng 111, 112 English Composition	6
Electives (English or Modern Languages)	6
Social Sciences and Humanities (21 Credits)	
Electives from Group D	21
Physical and Biological Sciences (29 Credits)	
MA 111 Algebra and Trigonometry	4
MA 112 Analytic Geometry and Calculus A	
or	
MA 102 Analytic Geometry and Calculus I	4
CH 101, 103 General Chemistry I and II	8
PY 221 College Physics	5
or	
PY 211, 212 General Physics	8
BS 100 General Biology	4
Biological Sciences Elective	4
Electives (63 Credits) *	
Restricted electives from Group A* *	25
Departmental requirements and electives	26
Free electives	12
Sub-total	126
Physical Education	4
Military Science	
or	
Air Science	4
Total	134

* Group A includes the physical and biological sciences; Group B, economics and business management; Group C, applied science and technology; Group D, social sciences and humanities.

** Six credits may be elected from Groups B and C. Social Science majors may select from Group D.

Curriculum in Agricultural Technology

	Credits
AG 103 Orientation	1
Languages (12 Credits)	
ENG 111, 112 English Composition	6
ENG 231 Basic Speaking Skills	3
Elective (English or Modern Language)	3
Social Sciences and Humanities (21 Credits)	
EC 201 Economics	3
AGC 212 Economics of Agriculture	3
HI 261 The United States in Western Civilization	3
PS 201 The American Governmental System	3
RS 301 Sociology of Rural Life	3
Electives from Group D	6
Physical and Biological Sciences (33 Credits)	
MA 111 Algebra and Trigonometry	4
MA 112 Analytic Geometry and Calculus A	
or	
MA 102 Analytic Geometry and Calculus I	4
CH 101, 103 General Chemistry I and II	8
PY 221 College Physics	5
BS 100 General Biology	4
Biological Sciences Elective	4
SSC 200 Soils**	4
Electives (59 Credits) *	
Restricted electives from Groups A and B	8-11
Restricted electives from Group C	9-12
Departmental requirements and electives	27
Free electives	12
Sub-total	126
Physical Education	4
Military Science	
or	
Air Science	4
Total	134

* Group A includes the physical and biological sciences; Group B, economics and business management; Group C, applied science and technology; Group D, social sciences and humanities.

** Upon approval by the Director of Instruction, Geology 120 may be substituted for Soils.

Curriculum in Biological Sciences

	Credits
AG 103 Orientation	1
Languages (12 Credits)	
ENG 111, 112 English Composition	6
Modern Foreign Language	6
Social Sciences and Humanities (21 Credits)	
Electives	21
Physical Sciences and Mathematics (36 Credits)	
MA 102 Analytic Geometry and Calculus I	4
MA 201, 202 Analytic Geometry and Calculus II, III	8
CH 105, 107 General Chemistry and Qualitative Analysis	8
CH 221, 223 Organic Chemistry I, II	8
PY 211, 212 General Physics	8
Biological Sciences (28 Credits)	
BS 100 General Biology	4
BO 301 General Morphology	4
ZO 201 Animal Life	4
BO 421 or ZO 301 Plant or Animal Physiology	4
BO 412 Microbiology	4
GN 411 Principles of Genetics	4
BS 450 Senior Biology	4
Electives (28 Credits)	
Restricted electives from Groups A,B,C and D*	16
Free electives	12
Sub-total	126
Physical Education	4
Military Science or Air Science	4
Total	134

* Group A includes the physical and biological sciences; Group B, economics and business management; Group C, applied science and technology; Group D, social sciences and humanities.

GROUP ELECTIVES

GROUP A

PHYSICAL SCIENCES:

Chemistry:

CH 107	General and Qualitative Chemistry
CH 108	General and Quantitative Chemistry Lab
CH 215	Quantitative Analysis
CH 220	Introductory Organic Chemistry
CH 221	Organic Chemistry I
CH 223	Organic Chemistry II
CH 351	Introductory Biochemistry

Mathematics:

MA 201	Analytic Geometry and Calculus II
MA 202	Analytic Geometry and Calculus III
MA 211, 212	Analytic Geometry and Caluculus B and C
MA 215	Finite Mathematics

Mineral Industries:

MIG 120	Physical Geology
MIG 220	Physical-Historical Geology

Physics:

PY 208	General Physics
PY 223	Astronomy and Astrophysics

Soil Science:

SSC 220	Soils
SSC 302	Soils and Plant Growth
SSC 452	Soil Classification
SSC 511	Soil Physics
SSC 522	Soil Chemistry

Statistics:

ST 302	Machine Techniques for Data Processing
ST 311	Introduction to Statistics
ST 361, 362	Introduction to Statistics for Engineers

BIOLOGICAL SCIENCES:

Agricultural Engineering:

AGE 303	Energy Conversion for Agricultural Production

Animal Science:

ANS 312	Principles of Livestock Nutrition
ANS 408	Reproduction and Lactation

Bacteriology:

BO 412	General Microbiology

Botany:

BO 214	Dendrology
BO 301	General Morphology
BO 403	Systematic Botany
BO 421	Plant Physiology
BO 442	General Ecology

Entomology:

ENT 301	Introduction to Forest Insects
ENT 312	Introduction to Economic Insects

Food Science:

FS 502	Food Chemistry
FS 505	Food Microbiology
FS 506	Advanced Food Microbiology

Genetics:

GN 301	Genetics in Human Affairs
GN 411	Principles of Genetics
GN 512	Genetics
GN 513	Cytogenetics

Plant Pathology:

PP 315	Plant Diseases
PP 318	Diseases of Forest Trees
PP 500	Advanced Plant Pathology
PP 501	Advanced Plant Pathology Lab, Field Crop Diseases
PP 502	Advanced Plant Pathology Lab, Horticulture Crop Diseases

Poultry Science:

PO 401	Poultry Diseases
PO 521	Poultry Nutrition
PO 524	Comparative Endocrinology

Zoology:

ZO 201	Animal Life
ZO 212	Human Anatomy
ZO 213	Human Physiology
ZO 223	Comparative Anatomy
ZO 315	Animal Parasitology
ZO 345	Histology
ZO 421	Animal Physiology
ZO 442	General Ecology

Other courses in the Physical and Biological Sciences not presently listed may be elected upon approval of the Director of Instruction.

GROUP B

ECONOMICS AND BUSINESS MANAGEMENT

Students in the Agricultural Business curriculum will select one course each in the areas of accounting, macro-economics, marketing and management. In addition, two courses will be selected in the area of general business and two courses in general economics. It is suggested that students in Agricultural Science and Agricultural Technology choose Group B electives from the first four areas.

1. Accounting:	EC 312	Accounting I
2. Macro-economics:	EC 302	National Income and Economic Welfare
3. Marketing:	EC 411	Marketing Methods
	or	
	AGC 311	Organization and Business Management of Marketing Firms
4. Management:	EC 425	Industrial Management
	or	
	AGC 303	Organization and Business Management of Farms

5. General Business: (select two courses)

EC 313	Accounting II
EC 407	Business Law I
EC 409	Introduction to Production Costs
EC 414	Tax Accounting
EC 417	Economic Dynamics
EC 420	Corporation Finance
EC 426	Personnel Management
EC 431	Labor Problems
EC 432	Industrial Relations
EC 525	Management Policy and Decision Making
AGC 413	Farm Appraisal and Finance
AGC 523	Planning Farm and Area Adjustments

6. General Economics: (select two courses)

EC 310	Economics of the Firm
EC 410	Industry Studies
EC 413	Competition, Monolopy and Public Policy
EC 440	Economics of Growth
EC 446	Economic Forecasting
EC 448	International Economics
EC 450	Economic Decision Processes
AGC 431	Agricultural Price Analysis
AGC 521	Procurement, Processing and Distribution of Agricultural Products
AGC 533	Agricultural Policy
AGC 551	Agricultural Production Economics
AGC 552	Consumption, Distribution and Prices in Agriculture

GROUP C

APPLIED SCIENCE AND TECHNOLOGY:

Agricultural Communications:

AC 311	Agricultural Communications Methods and Media

Agricultural Engineering:

AGE 211	Farm Machinery
AGE 321	Irrigation, Terracing and Erosion Control
AGE 331	Food Engineering
AGE 332	Farm Structures
AGE 341	Farm Electrification and Utilities
AGE 411	Farm Power and Machinery
AGE 433	Crop Preservation and Processing

Animal Science:

ANS 201	Elements of Dairy Science
ANS 202	Fundamentals of Animal Husbandry
ANS 302	Selecting Dairy and Meat Animals
ANS 303	Meat and Meat Products
ANS 308	Advanced Selecting Dairy and Meat Animals
ANS 309	Meat Selection
ANS 404	Dairy Farm Problems
ANS 407	Advanced Livestock Production
ANS 503	Genetic Improvement of Livestock
ANS 505	Diseases of Farm Animals

Crop Science:

CS 211	Crop Science I
CS 311	Field Crops II
CS 312	Pastures and Forage Crops
CS 315	Turf Management
CS 413	Plant Breeding
CS 414	Weeds and Their Control
CS 511	Tobacco Technology

Food Science:

FS 303	Meat and Meat Products
FS 309	Meat Selection
FS 331	Food Engineering
FS 401	Market Milk and Related Products
FS 404	Poultry Products

Horticultural Science:

HS 201	Principles of Horticulture
HS 301	Plant Propagation
HS 342	Landscape Gardening
HS 421	Fruit Production
HS 432	Vegetable Production
HS 441, 442	Floriculture I and II
HS 481	Breeding of Horticultural Plants

Poultry Science:

PO 201	Poultry Production
PO 301	Poultry Quality Evaluations
PO 351	Poultry Grading
PO 402	Commercial Poultry Enterprises
PO 404	Poultry Products
PO 520	Poultry Breeding

Soil Science:

SSC 341	Soil Fertility and Fertilizers
SSC 461	Soil Conservation and Management
SSC 472	Forest Soils

Zoology:

ZO 221	Conservation of Natural Resources
ZO 551, 552	Wildlife Science

Other courses in Applied Science and Technology and Group C electives from other schools not presently listed may be elected upon approval of the Director of Instruction.

GROUP D

SOCIAL SCIENCES AND HUMANITIES:

Art:

ART 200	Visual Art, Contemporary Life

Agricultural Economics:

AGC 212	Economics of Agriculture
AGC 441	Agricultural Development in Foreign Countries
AGC 512	Economic Analysis of Factor Markets

Anthropology:

ANT 252	Cultural Anthropology
ANT 305	Peoples of the World

Economics:

EC 201, 202	Economics
EC 301	Production and Prices
EC 442	Evolution of Economic Ideas
EC 501	Intermediate Economic Theory
EC 502	Money, Income and Employment
EC 541	Origins of the United States Economy

History:

HI 201	The Ancient World
HI 202	The Medieval World
HI 205	The Modern Western World
HI 245, 246	History of European Civilization
HI 251	The United States through Reconstruction
HI 252	The United States since Reconstruction
HI 261	The United States in Western Civilization

Literature:

American, English and Modern Language	May be used as a Group D elective if not used to complete the 12 required hours in the language area.

Music:

MU 200	Music Appreciation

Political Science:

PS 201	The American Governmental System
PS 202	County and Municipal Government
PS 301	Comparative Government: Democracies
PS 302	Comparative Government: Totalitarian States
PS 376	Latin American Government and Politics

Philosophy:

PHI 201	Logic
PHI 203	Introduction to Philosophy
PHI 205	Problems and Types of Philosophy
PHI 305	Philosophy of Religion
PHI 306	Philosophy of Art
PHI 307	Ethics
PHI 309	Marriage and Family Living
PHI 311	Parent-Child Relationships
PHI 395	Philosophical Analysis

Psychology:

PSY 200	Introduction to Psychology
PSY 302	Psychology of Personality and Adjustment
PSY 304	Educational Psychology

Religion:

REL 301	Religious Groups and Trends in the U.S.
REL 302	Bible and Its Background
REL 303	Christian Ethics
REL 403	Religions of the World

Rural Sociology:

RS 301	Sociology of Rural Life
RS 321	Introduction to Social Research
RS 322	Introduction to Rural Social Work
RS 441	Rural Social Pathology
RS 442	Rural Social Structure

Sociology:

SOC 202	Principles of Sociology
SOC 301	Human Behavior
SOC 302	Public Relations and Modern Society
SOC 303	Current Social Problems
SOC 304	Contemporary Family Life
SOC 305	Race Relations
SOC 306	Criminology

Social Studies:

SS 301, 302	Science and Civilization
SS 491, 492	Contemporary Issues

Other courses in Social Sciences and Humanities not presently listed may be elected upon approval of the Director of Instruction.

AGRICULTURAL ECONOMICS

Professor CHARLES E. BISHOP, *Head of the Department*

TEACHING AND RESEARCH

Professors:
A. J. COUTU, H. B. JAMES, R. A. KING, J. G. MADDOX, W. H. PIERCE, G. S. TOLLEY, W. D. TOUSSAINT, J. C. WILLIAMSON, JR.

USDA Professor:
J. G. SUTHERLAND

Associate Professors:
W. R. HENRY, D. M. HOOVER, P. R. JOHNSON, J. A. SEAGRAVES, R. L. SIMMONS, T. D. WALLACE

Assistant Professors:
J. S. CHAPPELL, L. A. IHNEN, C. Y. LIU, D. F. NEUMAN, E. C. PASOUR, JR., R. J. PEELER, JR., D. A. WEST

Instructors:
D. J. BIGGAR, J. E. BERRY, W. E. BOYET, G. L. BRADFORD, A. B. CARROLL, J. D. COFFEY, J. O. FRYE, F. M. GOODE, R. N. S. HARRIS, E. F. JANSEN, JR., G. K. KRIPALANI, J. C. MATTHEWS, JR., D. D. OSBURN, G. S. SANFORD, R. A. SCHRIMPER, YI WANG, T. K. WHITE, JR.

EXTENSION

Associate Professor CHARLES R. PUGH, *In Charge of Farm Management and Public Affairs*

Professor:
W. L. TURNER

Associate Professor:
C. R. WEATHERS

Assistant Professors:
J. G. ALLGOOD, E. W. JONES, D. G. HARWOOD

Instructors:
H. L. LINER, P. S. STONE

Professor GEORGE L. CAPEL, *In Charge of Marketing*

Associate Professors:
R. S. BOAL, G. R. CASSELL, L. H. HAMMOND, H. A. HOMME, T. E. NICHOLS, JR., E. A. PROCTOR

Assistant Professor:
RUBY P. UZZLE

Instructors:
R. C. BROOKS, R. D. DAHLE

The Department of Agricultural Economics offers programs of study leading to the Bachelor of Science, Master of Agricultural Economics, Master of Science and Doctor of Philosophy degrees.

Two options are available to undergraduate students majoring in agricultural economics. These options include agricultural business and agricultural science. Students are given training in all aspects of organizing and operating agricultural business firms. A sound foundation in basic economic principles in production and marketing is pro-

vided in order that graduates will be able to deal with problems associated with the rapid changes in technical and economic conditions.

The general objectives of the department are as follows:

(1) To train students in the fundamentals of business organization and to make sound decisions in organizing and managing farms and other agricultural businesses.

(2) To instruct students in economic theory which may be used as a basis for understanding the relationship of agriculture to other parts of the economy and for the evaluation of agricultural policy and economic changes which affect agriculture.

(3) To train graduate students in advanced economic theory and research techniques.

OPPORTUNITIES

Training in agricultural economics qualifies a student for a wide range of opportunities. Many graduates of the department are employed in research and educational work by various agencies of the federal and state governments. These agencies include the Agricultural Extension Service, the Agricultural Experiment Station, the State Department of Agriculture and other agencies of the United States Department of Agriculture.

The growing number of companies processing and manufacturing agricultural products has created an increasing demand for people trained in agricultural economics. Opportunities include employment by companies handling farm supplies such as feed, fertilizer, and equipment; general marketing and processing firms; agricultural cooperatives; professional farm management agencies and various credit agencies.

Openings in all of these areas greatly exceed the number of graduates trained to fill them. As industrial and agricultural development of the region continues, employment opportunities are expected to increase.

FACILITIES

The department has a modern and well-equipped library, including all of the major professional journals and USDA publications. Experiment station publications from other institutions throughout the United States are kept on file. Modern computational and reproduction equipment is available. Computational facilities are ideal for students whose research problems involve extensive manipulation of data as well as for those students who want to learn to do their own programming. The department has a well-trained clerical staff and maintains a one-half interest in an IBM 1620 computer. In addition, the department has access to an IBM 1410 and a Rand 1105. The department is housed in Patterson Hall.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in Agricultural Economics may be earned under the agricultural business and agricultural science curricula in the School of Agriculture and Life Sciences. In addition to the courses listed below, students must meet all of the basic requirements of the University and the School of Agriculture and Life Sciences.

For the freshman year and basic requirements see pages 59-66.

Agricultural Business—The requirements for the agricultural business curriculum are as follows:

Group B Courses (24 Credits)

	Credits
AGC 303 Organization and Business Management of Farms	3
AGC 311 Organization and Business Management of Marketing Firms	3
AGC 551 Agricultural Production Economics	3
AGC 552 Consumption, Distribution and Prices in Agriculture	3
EC 302 National Income and Economic Welfare	3
EC 312 Accounting I	3
Electives	6

Group A and C Courses (6 Credits)

	Credits
Electives	6

Departmental Requirements and Electives (26 Credits)

	Credits
ST 311 Introduction to Statistics	3
AGC 533 Agricultural Policy	3
AGC 413 Farm Appraisal and Finance	
or	
AGC 431 Agricultural Price Analysis	3
AGC 521 Procurement, Processing and Distribution of Agricultural Products	
or	
AGC 523 Planning Farm and Area Adjustments	3
Electives	14

Agricultural Science—The requirements of the agricultural science curriculum are as follows:

Group A Courses (26 Credits)

	Credits
MA 211 and 212, Analytic Geometry and Calculus B, C	
or	
MA 201 and 202, Analytic Geometry and Calculus II and III	6 or 8
ST 311 Introduction to Statistics	3
Electives	15 or 17

Departmental Requirements and Electives (26 Credits)

	Credits
AGC 303 Organization and Business Management of Farms	3
AGC 311 Organization and Business Management of Marketing Firms	3
AGC 533 Agricultural Policy	3
AGC 551 Agricultural Production Economics	3
AGC 552 Consumption, Distribution and Prices in Agriculture	3
EC 312 Accounting I	3
EC 302 National Income and Economic Welfare	3
Electives	5

GRADUATE STUDY

The Department of Agricultural Economics offers programs of study leading to the Master of Agricultural Economics, the Master of Science and the Doctor of Philosophy degrees.

Special emphasis is placed on the economics of agricultural production and marketing, analysis of programs and policies affecting agriculture and statistical techniques which can be used in solving agricultural problems.

AGRICULTURAL ENGINEERING

Professor F. J. Hassler, *Head of the Department*

TEACHING AND RESEARCH

Professors:
H. D. Bowen, J. M. Fore, W. E. Splinter, J. W. Weaver, Jr.

Associate Professors:
E. L. Howell, K. A. Jordan, C. W. Suggs

Assistant Professors:
G. B. Blum, Jr., B. K. Huang, E. G. Humphries, W. H. Johnson, D. A. Link

Instructors:
W. F. McClure, E. H. Wiser, F. S. Wright

Head Mechanic:
R. B. Greene

EXTENSION

Professor H. M. Ellis, *In Charge*

Associate Professors:
J. C. Ferguson, R. M. Ritchie, W. C. Warrick

Assistant Professors:
J. W. Glover, R. W. Watkins

Instructors:
R. E. Sneed, E. M. Stallings

Students in agricultural engineering are educated and trained to deal with problems of agriculture that are engineering in nature. Involved are the application of scientific and engineering principles to the conservation and utilization of water and soil, the development of power and labor-saving devices for all phases of agricultural production, the design of structures and equipment for housing and handling livestock and field products and the processing and marketing of farm products.

The need for men to carry out the technical aspects such as development and research as well as less technical work, such as sales and service of farm equipment, requires the offering of two distinct curricula as described below.

The Department of Agricultural Engineering is housed in the Agricultural Engineering Building.

OPPORTUNITIES

Men trained in agricultural engineering under the science curriculum are qualified for positions in design, development and research in public institutions and in industry, and for teaching and extension work in institutions of higher education. The curriculum also provides adequate training for postgraduate work leading to advanced degrees.

Men trained in the field of agricultural engineering technology are qualified for positions in sales and service of agricultural equipment such as farm machinery, irrigation systems, etc.; as county agents or farmers; and for farm advisory work with such organizations as electric power companies.

UNDERGRADUATE CURRICULUM

Agricultural Science—This curriculum, offered in conjunction with the School of Engineering, is designed to develop young men capable of engineering leadership in agriculture. Emphasis is placed on basic science courses such as mathematics, physics, mechanics, biology, soils and thermodynamics, which provide a sound background for engineering and agricultural technology. Courses in agricultural engineering are directed to those methods of thought and techniques whereby science can be applied with understanding and judgment to engineering situations in agricultural operations. General agriculture courses are provided in order that the student can better understand the agricultural industry with which he deals.

Since agricultural engineering involves two distinct technical fields —agriculture and engineering—this curriculum is a joint responsibility of the two schools and is so administered. Graduates in the program receive the degree of Bachelor of Science in Agricultural Engineering.

For the freshman year program in Agricultural Engineering Science, refer to the common freshman year in the School of Engineering on page 59.

SOPHOMORE

	Credits
MA 202 Analytic Geometry and Calculus III	4
MA 301 Differential Equations I	3
PY 208 General Physics	5
AGE 251 Tools and Materials	3
EC 205 The Economic Process	3
AG 103 Orientation	1
EM 200 Introduction to Mechanics	3
ENG 205 Reading for Discovery	3
SSC 200 Soils	4
BS 100 General Biology	4
MS 201, 202 Military Science II or AS 221, 222 Air Science II	2
Physical Education	2
	37

JUNIOR

	Credits
EM 301 Solid Mechanics I	3
EM 303 Fluid Mechanics I	3
AGE 361 Analytical Methods	3
ME 301 Engineering Thermodynamics I	3
AGE 303 Energy Conversion for Agricultural Production	2
SS 301, 302 Science and Civilization	6
EE 331, 332 Principles of Electrical Engineering I, II	8
ST 361 Introduction to Statistics for Engineers	3
AGE 352 Control of Environment	2
Humanities Elective	3
	36

SENIOR

	Credits
CE 201 Engineering Measurements	3
AGE 461 Analysis of Agricultural Production Systems	3
AGE 453 Bioengineering Parameters	2
AGE 491 Electrotechnology for Agricultural Production	3
SS 491 or 492 Contemporary Issues	3
AGE 471 Soil and Water Conservation Engineering	3
AGE 462 Functional Design of Field Machines	3
AGE 481 Design of Farmstead Engineering Systems	3
PY 407 Introduction to Modern Physics	3
Free Elective	6
	32

Agricultural Engineering Technology—This curriculum is designed for those who are working on a practical level with farm people. Graduates are equipped to apply to the farm the new technology as developed and revealed by the research engineer. The courses are presented and directed toward the solution of consumer problems with emphasis on the techniques employed.

Graduates from this program will receive the degree of Bachelor of Science.

For the freshman year program in agricultural engineering technology see pages 59-60.

The requirements of the agricultural engineering technology curriculum are as follows:

Group A and B Courses (10-12 Credits)

	Credits
*PY 211, 212 General Physics (8 credits total)	3
Electives	7-9

Group C Courses (9-11 Credits)

	Credits
Electives	9-11
Departmental Requirements and Electives (26 Credits)	
AGE 211 Farm Machinery	4
AGE 303 Energy Conversion for Agricultural Production	2
AGE 321 Irrigation, Drainage and Erosion Control	3
AGE 411 Farm Power and Machinery	3
AGE 332 Farm Buildings	3
AGE 341 Farm Electrification and Utilities	3
AGE 433 Crop Preservation and Processing	3
E 101 Engineering Graphics I	2
AGE 331 Food Engineering	3

* PY 211 and 212 will be taken in place of PY 221 as shown in the Agricultural Technology Curriculum. These 3 additional credits are Group A electives required by the department.

GRADUATE STUDY

The Department of Agricultural Engineering offers programs of study for the Master of Science, Doctor of Philosophy and Master of

Agricultural Engineering degrees. A bachelor's degree in Agricultural Engineering from an accredited curriculum or its equivalent entitles an individual to one of two approaches to graduate study. For those interested primarily in existing technologies, the Master of Agricultural Engineering program permits selections from a variety of advanced technical courses. Such study is appropriate to certain supervisory and managerial positions, technical sales, service and promotional work.

The Master of Science program takes into account the increasing rigor of modern engineering. Emphasis here is placed on mathematics and theory as the unifying link between otherwise widely divergent fields of knowledge, which are prerequisite to effective engineering advances in agricultural productions. As the student acquires competence in the advanced methods of science, he derives mathematical models for reduction of observational knowledge to engineering applications.

Study for the Doctor of Philosophy degree builds on the above Master of Science program by an additional year of formal study followed by a period of independent research to satisfy dissertation requirements.

Unusual opportunities are available for graduate student participation in departmental research programs. Current projects include: Animal Environment; Watershed Hydrology, Drainage and Irrigation; Crop Processing and Materials Handling; Field Production Operations; Fruit and Vegetable Mechanization; Pesticide Applications; Human Engineering; Systems Engineering. The systems approach to operations in crop and animal productions provides a variety of areas within which to define timely investigations.

Graduate students have access to a research shop which is manned by competent mechanics.

AGRONOMY

See Crop Science and Soil Science.

ANIMAL SCIENCE

Professor I. D. PORTERFIELD, *Head of the Department*

TEACHING AND RESEARCH

Professors:

E. R. BARRICK, E. G. BATTE, GEORGE HYATT, J. G. LECCE, J. E. LEGATES, G. MATRONE, W. R. MURLEY, H. A. RAMSEY, F. H. SMITH, H. A. STEWART, S. B. TOVE, L. C. ULBERG, G. H. WISE, M. B. WISE

Associate Professors:

A. J. CLAWSON, E. U. DILLARD, LEMUEL GOODE, R. D. MOCHRIE, W. W. G. SMART, JR.

Assistant Professors:
E. V. Caruolo, D. G. Davenport, E. J. Eisen, J. M. Leatherwood, J. J. McNeill, D. J. Moncol, J. L. Moore, R. M. Myers, A. H. Rakes, O. W. Robison

Instructors:
J. H. Gregory, W. A. Wilder, Jr.

EXTENSION

Professors:
A. V. Allen, T. C. Blalock, J. S. Buchanan, J. D. George, Jack Kelley, M. E. Senger

Associate Professors:
G. S. Parsons, J. W. Patterson, J. R. Woodard

Assistant Professors:
J. R. Jones, F. N. Knott, V. H. Lytton, R. L. McGuire, R. R. Rich, D. G. Spruill

Instructors:
D. C. Pardue, F. D. Sargent

Undergraduate students in the Department of Animal Science are instructed in the basic principles of subjects relating to various phases of dairy and livestock production. The program of course work is sufficiently flexible to permit specialization in any one of several areas: animal husbandry, dairy husbandry, nutrition and animal breeding. Thus, the purpose of these offerings is to present challenges and to provide preparation of students from various backgrounds for constructive and progressive participation in the ever-expanding fields of animal agriculture.

OPPORTUNITIES

There are many and varied opportunities for students who major in animal science. These vocational opportunities include farm operations, dairy herd and livestock management, fieldmen for breed associations and livestock organizations, agricultural extension, educational work in business and industries serving agriculture, meat grading, agricultural communications in animal industry, feed manufacturing, sales work in feeds and equipment, marketing dairy cattle and dairy products, livestock buying, livestock and farm loans with banks and lending agencies. In addition, students may pursue further study at the graduate level, after which they will find opportunities in teaching as well as research and development.

UNDERGRADUATE CURRICULUM—ANIMAL SCIENCE

The degree of Bachelor of Science with a major in animal science may be obtained under any of the three curricula offered by the School of Agriculture and Life Sciences. For the basic requirements in orientation, language, social science and humanities, physical education, military and air science, and free electives, see pages 59-66.

Agricultural Business—The requirements of the agricultural business curriculum are as follows:

Physical and Biological Sciences (25 Credits)

	Credits
MA 111 Algebra and Trigonometry	4
MA 112 Analytical Geometry and Calculus A	4
CH 101 General Chemistry I	4
PY 221 College Physics	5
BS 100 General Biology	4
ZO 421 Animal Physiology	4

Group A Courses (7 Credits)

CH 103 General Chemistry II	4
GN 411 Principles of Genetics	3

Group B Courses (24 Credits)

Electives	24

Departmental Requirements and Electives (24 Credits)

CH 220 Introductory Organic Chemistry or	
CH 221 Organic Chemistry I	4
ANS 201 Elements of Dairy Science or	
ANS 202 Fundamentals of Animal Husbandry	4
ANS 490 Animal Science Seminar	1
Credits remaining to be elected	15

A. Minimum of 11 credits must be elected from the following courses in the Department of Animal Science:

ANS 302 Selecting Dairy and Meat Animals	2
ANS 312 Principles of Livestock Nutrition	3
ANS 404 Dairy Farm Problems	3
ANS 407 Advanced Livestock Production	4
ANS 408 Reproduction and Lactation	3
ANS 503 Genetic Improvement of Livestock	3
ANS 505 Diseases of Farm Animals	3

B. Remaining credits must be elected from courses in Group A (Physical and Biological Sciences) and Group C (Applied Science and Technology).

Agricultural Science—The requirements of the agricultural science curriculum are as follows:

Physical and Biological Sciences (29 Credits)

	Credits
MA 111 Algebra and Trigonometry	4
MA 112 Analytical Geometry and Calculus A	4
CH 101 General Chemistry I	4
CH 103 General Chemistry II	4
PY 221 College Physics	5
BS 100 General Biology	4
ZO 421 Animal Physiology	4

Group A Courses (25 Credits)

CH 220 Introductory Organic Chemistry or	
CH 221 Organic Chemistry I	4
GN 411 Principles of Genetics	3
BO 412 General Microbiology	4
Electives, 6 credits of which may be selected from Groups B and C	14

Departmental Requirements and Electives (26 Credits)

ANS 201 Elements of Dairy Science or	
ANS 202 Fundamentals of Animal Husbandry	4
ANS 490 Animal Science Seminar	1
Credits remaining to be elected	21

A. Minimum of 9 credits must be elected from the following courses in the Department of Animal Science:

ANS 312 Principles of Livestock Nutrition	3
ANS 404 Dairy Farm Problems	3
ANS 407 Advanced Livestock Production	4
ANS 408 Reproduction and Lactation	3
ANS 503 Genetic Improvement of Livestock	3
ANS 505 Diseases of Farm Animals	3

B. Remaining credits must be elected from courses in Group A (Physical and Biological Sciences) and Group C (Applied Science and Technology).

Agricultural Technology—The requirements of the agricultural technology curriculum are as follows:

Physical and Biological Sciences (33 Credits) — *Credits*

MA 111 Algebra and Trigonometry 4
MA 112 Analytical Geometry and Calculus A 4
CH 101 General Chemistry I 4
CH 103 General Chemistry II 4
PY 221 College Physics 5
BS 100 General Biology 4
ZO 421 Animal Physiology 4
SSC 200 Soils 4

Group A and B Courses (10 Credits)

CH 220 Introductory Organic Chemistry
or
CH 221 Organic Chemistry I 4
GN 411 Principles of Genetics 3
Elective 3

Group C Courses (9 Credits)

Electives 9

Departmental Requirements and Electives (28 Credits)

ANS 201 Elements of Dairy Science
or
ANS 202 Fundamentals of Animal Husbandry 4
ANS 490 Animal Science Seminar 1
Credits remaining to be elected 23

A. Minimum of 11 credits must be elected from the following courses in the Department of Animal Science:
   - ANS 302 Selecting Dairy and Meat Animals 2
   - ANS 312 Principles of Livestock Nutrition 3
   - ANS 404 Dairy Farm Problems 3
   - ANS 407 Advanced Livestock Production 4
   - ANS 408 Reproduction and Lactation 3
   - ANS 503 Genetic Improvement of Livestock 3
   - ANS 505 Diseases of Farm Animals 3

B. Remaining credits must be elected from courses in Group A (Physical and Biological Sciences) and Group C (Applied Science and Technology).

GRADUATE STUDY—ANIMAL SCIENCE

The department offers both the Master of Science and the Doctor of Philosophy degrees in the areas of animal husbandry, dairy husbandry, animal biochemistry and nutrition, animal diseases, animal physiology and animal breeding.

BIOLOGICAL SCIENCES

The biological sciences curriculum emphasizes the basic biological and physical sciences. It is designed as preparatory for advanced study at the graduate or professional level and for educational careers in biology.

For details of this interdepartmental curriculum see page 61.

BOTANY AND BACTERIOLOGY

Professor G. R. NOGGLE, *Head of the Department*

TEACHING AND RESEARCH

Professor Emeritus:
B. W. WELLS

Professors:
D. B. ANDERSON, E. A. BALL, E. O. BEAL, J. B. EVANS,* H. T. SCOFIELD, L. A. WHITFORD

Associate Professors:
A. W. COOPER, G. H. ELKAN, J. W. HARDIN, J. R. TROYER

* On leave until Sept. 1, 1965.

Assistant Professors:
F. B. Armstrong, W. J. Dobrogosz, J. S. Kahn, H. E. Pattee, J. J. Perry, H. Seltmann, R. E. Williamson

Visiting Assistant Professor:
E. F. Carell

The course program in the department has the objective of providing undergraduate and graduate instruction in the various specialized phases of basic plant science including microbiology. Undergraduates majoring in the department are usually oriented toward graduate work in this or other fields of science. Courses are supplemented by supervised programs of research for graduate students studying for master's or doctor's degrees. Course work in the department also is designed to provide a basis for study in the applied sciences in agriculture and forestry.

OPPORTUNITIES

Majors in botany and bacteriology may choose to continue graduate work leading to the Master of Science and Doctor of Philosophy degrees in one of the several specialized fields. Majors specializing in botany are qualified for many technological positions with various government institutions or private industries concerned with agriculture. Majors specializing in bacteriology find employment opportunities in medical and agricultural industry or in the field of public health.

UNDERGRADUATE CURRICULUM—BOTANY

The Bachelor of Science degree with a major in the agricultural science curriculum from the School of Agriculture and Life Sciences can be obtained in botany. For the freshman year and basic requirements see pages 59-60. The departmental requirements are as follows:

Group A Courses (25 Credits)

It is recommended that CH 105 and CH 107 be taken in place of CH 101 and 103.

Course work in organic chemistry is required which would consist of either CH 220 or CH 221-223.

Electives may be selected from basic science areas to complete the total of 25 credit hours. No more than 6 credits in Group A electives may be in the Department of Botany and Bacteriology. Six credits may be selected from Groups B and C.

Departmental Requirements (26 Credits)

	Credits
BO 301 General Morphology	4
BO 403 Systematic Botany	3
BO 421 Plant Physiology	4
BO 442 General Ecology	4
GN 411 Principles of Genetics	3
PP 315 or 318 Plant Diseases, Disease of Forest Trees	3
BO 412 General Microbiology	4
Elective	1

UNDERGRADUATE CURRICULUM—BACTERIOLOGY

The department does not offer an undergraduate major program in bacteriology. Students interested in this discipline are advised to take the biological sciences curriculum and to select electives in microbiology. This will provide excellent preparation for either graduate work or for employment as a microbiologist. Anyone interested in undergraduate work emphasizing bacteriology should see a departmental advisor for guidance in choosing appropriate electives.

GRADUATE STUDY

The department offers work leading to the Master of Science and Doctor of Philosophy degrees in the special fields of anatomy, bacteriology, ecology, morphology, phycology, physiology and systematic botany.

CROP SCIENCE

Professor P. H. Harvey, *Head of the Department*

TEACHING AND RESEARCH

Professor Emeritus:
G. K. Middleton

Professors:
C. A. Brim, D. S. Chamblee, D. U. Gerstel, W. C. Gregory, G. L. Jones, K. R. Keller, G. C. Klingman, R. L. Lovvorn, T. J. Mann, P. A. Miller, R. P. Moore, L. L. Phillips, J. C. Rice, D. L. Thompson, R. P. Upchurch, J. A. Weybrew

Associate Professors:
W. A. Cope, J. W. Dudley, D. A. Emery, W. B. Gilbert, H. D. Gross, J. A. Lee, W. M. Lewis, F. W. McLaughlin, J. R. Mauney, D. E. Moreland, Luther Shaw, E. C. Sisler, D. H. Timothy

Assistant Professors:
W. T. Fike, G. R. Gwynn, J. L. Hall, D. A. Miller, C. F. Murphy, J. B. Weber, E. A. Wernsman, D. C. Whitenberg

Instructors:
M. R. Godfrey, A. J. Kapplemann, Jr., P. W. Perry, F. L. Selman

EXTENSION

Professor E. R. Collins, *In Charge of Agronomy Extension*

Professors:
R. R. Bennett, S. H. Dodson, A. D. Stuart

Associate Professors:
C. T. Blake, S. N. Hawkes, Astor Perry, A. D. Worsham

Assistant Professors:
D. M. Gossett, H. G. Small

Instructors:
J. G. Clapp, T. R. Terrill, W. G. Toomey

The curriculum in crop science has as its objectives training the student in the fundamental principles of the plant sciences, along with the application of these principles to the problems of crop production.

The importance of agronomic training in North Carolina agriculture is shown by the fact that the State ranks third among the states in cash income from farm crops. Yet the maximum potential production of farm crops has by no means been reached. With continued improvement in varieties, cultural practices and cropping methods, further advances will be made. In carrying out this broad program there is, and will continue to be, a real need in North Carolina for men well trained in plant breeding, weed control, crop production and management and related fields.

The Department of Crop Science is housed in Williams Hall.

OPPORTUNITIES

Graduates in crop science are trained to fill positions as county extension agents; farm operators and managers; salesmen in seed, fertilizer and agricultural chemical companies and similar commercial concerns; seed analysts; and as leaders in various forms of agricultural development work. The crop science programs also offer training for those students who might want to continue their education with graduate study in preparation for extension, teaching or research positions with state or federal institutions or private industry.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in crop science is offered under the agricultural business and agricultural science curricula of the School of Agriculture and Life Sciences. Students may also earn the degree of Bachelor of Science under the agricultural technology curriculum with a major in agronomy. The agronomy option is administered jointly by the Departments of Crop Science and Soil Science.

For the freshman year and basic requirements see pages 59-60.

Agricultural Business—The requirements of the agricultural business curriculum are as follows:

Group B Courses (24 Credits)

	Credits
AGC 303 Organization and Business Management of Farms	3
AGC 311 Organization and Business Management of Marketing Firms	3
EC 407 Business Law I	3
Electives	15

Group A and C Courses (6 Credits)

GN 411 The Principles of Genetics	3
PP 315 Plant Diseases	3

Departmental Requirements and Electives (25 Credits)

	Credits
CS 211 Crop Science I	3
CS 312 Pastures and Forage Crops	3
CS 414 Weeds and Their Control	3
CS 490 Senior Seminar	1
BO 421 Plant Physiology	4
ENT 312 Economic Insects	3
SSC 200 Soils	4
SSC 302 Soils and Plant Growth or SSC 341 Soil Fertility and Fertilizers	3
Elective	1

Agricultural Science—The requirements of the agricultural science curriculum are as follows:

Group A Courses (25 Credits)

	Credits
BO 412 General Microbiology	4
CH 220, CH 351 Introduction to Organic Chemistry and Introduction to Biochemistry	
or	
CH 221, CH 223 Organic Chemistry I and Organic Chemistry II	7 or 8
GN 411 The Principles of Genetics	3
PP 315 Plant Diseases	3
MA 201 Analytic Geometry and Calculus II	
or	
MA 211 Analytic Geometry and Calculus B	4 or 3
*Electives	3-5

Departmental Requirements and Electives (26 Credits)

	Credits
CS 211 Crop Science I	3
CS 312 Pastures and Forage Crops	3
CS 414 Weeds and Their Control	3
CS 490 Senior Seminar	1
BO 421 Plant Physiology	4
ENT 312 Economic Insects	3
SSC 200 Soils	4
SSC 302 Soils and Plant Growth	
or	
SSC 341 Soil Fertility and Fertilizers	3
Elective	2

* Five credits may be elected from Groups B and C.

*Agricultural Technology (Agronomy)**—The requirements of the agricultural technology curriculum with a major in agronomy are as follows:

Physical and Biological Sciences

	Credits
BO 421 Plant Physiology	4

Group A and B Courses (10 Credits)

	Credits
CH 220 Introduction to Organic Chemistry	4
GN 411 The Principles of Genetics	3
PP 315 Plant Diseases	3

Group C Courses (10 Credits)

	Credits
Electives	10

Departmental Requirements and Electives (27 Credits)

	Credits
CS 211 Crop Science I	3
CS 312 Pastures and Forage Crops	3
CS 413 Plant Breeding	3
CS 414 Weeds and Their Control	3
CS 490 Senior Seminar	1
SSC 302 Soils and Plant Growth	
or	
SSC 341 Soil Fertility and Fertilizers	3
SSC 452 Soil Classification	3
SSC 461 Soil Conservation and Management	3
Electives	5

* The agronomy major is administered by the Departments of Crop Science and Soil Science and is listed jointly.

The Departments of Crop Science, Entomology and Plant Pathology offer a joint major in plant protection. See section on plant protection for details.

GRADUATE STUDY

The Department of Crop Science offers training leading to the degrees of Master of Science and Doctor of Philosophy in the following fields: plant breeding, crop production, forage crop ecology and weed control.

DAIRY HUSBANDRY

See Animal Science.

ENTOMOLOGY

Professor EDWARD H. SMITH, *Head of the Department*

TEACHING AND RESEARCH

Professor Emeritus:
T. B. MITCHELL

Professors:
C. H. BRETT, F. E. GUTHRIE, R. L. RABB, C. F. SMITH, D. A. YOUNG, JR.

Associate Professors:
W. V. CAMPBELL, W. C. DAUTERMAN, M. H. FARRIER, E. HODGSON, A. R. MAIN, W. J. MISTRIC, JR., H. H. NEUNZIG

Assistant Professors:
R. C. AXTELL, C. G. WRIGHT

Instructors:
M. D. JACKSON, H. B. MOORE, D. A. MOUNT

RESEARCH

Assistant Professors:
R. B. CHALFANT, G. F. TURNIPSEED

EXTENSION

Professor:
G. D. JONES

Associate Professor:
R. L. ROBERTSON

Assistant Professor:
J. M. FALTER

Visiting Professor:
W. G. BRUCE

Adjunct Assistant Professor:
E. W. CLARK

The entomology faculty offers instruction at both the undergraduate and graduate levels and provides students in this field with broad fundamental training necessary in this profession. Undergraduate instruction also is designed to provide introductory and terminal courses in insect control technology for students majoring in other areas of agriculture and forestry.

The Department of Entomology is housed in Gardner Hall.

OPPORTUNITIES

Opportunities for employment of well-trained entomologists are

plentiful and varied. Research and teaching opportunities exist in many state institutions. Federal agencies offer many positions in research and regulatory work. Private industry is using more and more entomologists in the development, production, control, testing and sale of agricultural chemicals. Other opportunities in entomology as consultants in domestic or foreign service, as well as in private business and sales, are available. One can go into business for himself as a pest control operator or an insecticide formulator.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in entomology is offered under the agricultural science curriculum of the School of Agriculture and Life Sciences.

For the freshman year and basic requirements see pages 59-60.

Agricultural Science—The requirements of the agricultural science curriculum are as follows:

Group A Courses (26 or 28 Credits)

	Credits
SSC 200 Soils	4
or	
MIG 120 Physical Geology	3
BO 412 General Microbiology	4
GN 411 Principles of Genetics	3
CH 351 Introductory Biochemistry, or Equivalent	3
ST 311 Introduction to Statistics	3
BO 421 Plant Physiology	4
or	
ZO 421 Animal Physiology	4
*Electives	3

Departmental Requirements and Electives (20 Credits)

	Credits
ENT 301 Introduction to Forest Insects	3
or	
ENT 312 Introduction to Economic Insects	3
ENT 502 Fundamentals of Entomology	5
ENT 503 Fundamentals of Entomology	5
Advised Electives	10

* May be taken from Groups B and C

Agricultural Technology—The Departments of Crop Science, Entomology and Plant Pathology offer a joint major in plant protection. See section on plant protection for details.

GRADUATE STUDY

The Master of Science and Doctor of Philosophy degrees are offered in entomology. The work in entomology is well supported by strong departments in chemistry, statistics, and the plant and animal sciences.

EXTENSION PERSONNEL DEVELOPMENT

Professor E. J. Boone, *Head of the Department*

TEACHING AND RESEARCH

Professors:
E. S. Cofer, F. S. Sloan

Visiting Professor:
C. M. Ferguson

Associate Professors:
R. J. Dolan, C. P. Marsh, E. H. Quinn

Cooperating with the following associate members of the faculty:
Agricultural Economics:
D. M. Hoover, J. G. Maddox

Agricultural Education:
H. E. Beam, C. C. Scarborough

Experimental Statistics:
C. H. Proctor

History and Political Science:
W. J. Block, P. W. Edsall

Psychology:
Thomas Baldwin

Rural Sociology:
C. H. Hamilton, S. C. Mayo

The Department of Extension Personnel Development faculty offers instruction at advanced undergraduate and graduate levels. The advanced undergraduate courses are designed to support the other departments of the institution, giving students a background in extension education. The graduate program is designed to increase the professional competence of extension workers and other adult educators in effecting change among people and in conducting scholarly research in the field.

The Department of Extension Personnel Development is housed in Ricks Hall.

UNDERGRADUATE CURRICULUM

The department does not have a program leading to a Bachelor of Science degree.

GRADUATE STUDY

Graduate study is carried out under the direction of the faculty of the Department of Extension Personnel Development. Students may qualify for the Master of Science or Master of Extension Education degree with a major in extension education.

The program is based upon an interdisciplinary approach and is designed to provide graduate students the opportunity to develop a broad and comprehensive understanding of adult education and a

high level of professional competence in conducting research. Bolstering the interdisciplinary base of the graduate program is a Graduate Institute of Extension Education which includes the deans of the Schools of Agriculture and Life Sciences, Education, Liberal Arts, and the Graduate School at North Carolina State and the dean of the School of Home Economics at the University of North Carolina at Greensboro.

A candidate for the master's degree must acquire a comprehensive understanding of the adult and society, and the theories of learning, social action, group processes, communication and planning requisite to effecting change among people. While a basic comprehension of these relevant theories is the first essential, the candidate must also understand their interrelationships and how they apply to adult education. The degree candidate must present a thesis based upon his own research.

The basic aspects of the behavioral sciences as related to extension and adult education is the central theme of the Department of Extension Personnel Development's graduate program. The varied but coordinated interests of the department's faculty with their research programs offer a variety of opportunities for graduate student training that is found at few institutions.

FOOD SCIENCE

Professor W. M. Roberts, *Head of the Department*

TEACHING AND RESEARCH

Professors:
L. W. Aurand, T. N. Blumer, Eloise Cofer, J. L. Etchells, M. W. Hoover, I. D. Jones, M. L. Speck, F. G. Warren, J. C. Williamson, Jr.

Associate Professors:
T. A. Bell, H. B. Craig, D. Fromm, A. E. Purcell

Assistant Professors:
R. J. Bingham, F. F. Busta, H. P. Fleming, V. A. Jones, H. E. Swaisgood, W. A. B. Thomson

EXTENSION

Professor:
J. A. Christian

Associate Professors:
F. R. Tarver, Jr., F. B. Thomas

Assistant Professors:
M. E. Gregory, N. C. Miller, Jr.

Instructor:
J. F. Wiles

The Department of Food Science has the objectives of providing undergraduate and graduate programs for the application and coor-

dination of basic training in the physical and biological sciences, economics and engineering to the development, processing, packaging, quality control, distribution and utilization of foods.

The department maintains modern and fully-equipped laboratories for teaching and research programs in dairy, fruit, meat, poultry, seafood and vegetable products.

The department head and several staff members of the Department of Food Science are housed in Polk Hall. Other staff members and teaching and research facilities are housed in Kilgore and Scott Halls.

OPPORTUNITIES

The increasing consumer demands for greater varieties and quantities of highly nutritious and convenience foods of uniformly high quality create many and varied career opportunities in the food and allied industries for qualified personnel.

Specific job opportunities in the food industries are procurement, processing, management, quality control, research and development, distribution, sales and merchandising. Some of the job opportunities in allied industries include sales and service representatives of companies manufacturing equipment and supplies for the food industries, consulting activities and trade association promotional and educational services.

Food scientists hold educational and regulatory positions in extension service, inspection, grading, research and development and quality control of foods with various state and federal governmental agencies. Food scientists are in demand for teaching and research positions with colleges and universities.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in food science and processing can be earned under any of the three curricula in the School of Agriculture and Life Sciences.

For the freshman year and basic requirements see pages 59-60.

Agricultural Business—The requirements of the Agricultural Business curriculum are as follows:

Group A Courses (8 Credits)

	Credits
BO 412 General Microbiology	4
CH 103 General Chemistry II	4

Group B Courses (24 Credits)

Electives	24

Departmental Requirements and Electives (23 Credits)

FS 301 Food Composition	3
FS 331 Food Engineering	3
FS 505 Food Microbiology	3
FS 590 Food Science Seminar	1
Electives	13

Agricultural Science—The requirements of the Agricultural Science curriculum are as follows:

Group A Courses (25 Credits)

	Credits
BO 412 General Microbiology	4
CH 221 Organic Chemistry I	4
CH 215 Quantitative Analysis	4
CH 351 Introductory Biochemistry	3
Electives	10

Departmental Requirements and Electives (26 Credits)

FS 331 Food Engineering	3
FS 502 Food Chemistry	3
FS 505 Food Microbiology	3
FS 590 Food Science Seminar	1
Electives	16

Agricultural Technology—The requirements of the Agricultural Technology curriculum are as follows:

Group A Courses (12 Credits)

	Credits
BO 412 General Microbiology	4
CH 221 Organic Chemistry I	4
CH 215 Quantitative Analysis	4
Group C Courses (9 Credits)	
Electives	9

Departmental Requirements and Electives (26 Credits)

CH 351 Introductory Biochemistry	3
FS 331 Food Engineering	3
FS 502 Food Chemistry	3
FS 505 Food Microbiology	3
FS 590 Food Science Seminar	1
Electives	13

GRADUATE STUDY

The Department of Food Science offers graduate programs of study leading to the Master of Science and Doctor of Philosophy degrees. Corollary instruction is provided in the biological and physical sciences. Areas of study and research include: (1) food chemistry, (2) food microbiology, and (3) food process and product development. These areas comprise all foods including dairy, fruit, meat, poultry, seafood and vegetable products.

GENETICS

Professor T. J. MANN, *Head of the Department*

Professors:
C. H. BOSTIAN, D. S. GROSCH, W. D. HANSON, K. KOJIMA, D. F. MATZINGER, H. F. ROBINSON, B. W. SMITH, S. G. STEPHENS

Associate Professors:
F. B. ARMSTRONG, L. E. METTLER, R. H. MOLL, A. C. TRIANTAPHYLLOU

Assistant Professors:
GENE NAMKOONG, L. C. SAYLOR, W. M. SCHUTZ

Associate Geneticist:
M. P. GREGORY

Assistant Geneticist: S. E. MOYER

Cooperating with the following associate members of the faculty:
Animal Science:
E. U. DILLARD, J. E. LEGATES, O. W. ROBISON, H. A. STEWART

Botany:
E. O. Beal, J. W. Hardin

Crop Science:
P. H. Harvey, C. A. Brim, W. A. Cope, J. W. Dudley, D. A. Emery, D. U. Gerstel, W. C. Gregory, Richard Gywnn, G. L. Jones, K. R. Keller, J. A. Lee, W. M. Lewis, P. A. Miller, L. L. Phillips, D. L. Thompson, D. H. Timothy, E. Wernsman

Horticulture Science:
F. D. Cochran, G. J. Galletta, F. L. Haynes, W. R. Henderson, D. T. Pope

Plant Pathology:
J. L. Apple*, T. T. Hebert, R. R. Nelson, N. T. Powell, N. N. Winstead

Poultry Science:
E. W. Glazener, W. L. Blow, G. A. Martin

Forestry:
T. O. Perry, B. J. Zobel, J. W. Duffield

Statistics:
C. C. Cockerham, J. O. Rawlings

OBJECTIVES

The genetics faculty offers instruction at advanced undergraduate and graduate levels. The undergraduate courses are designed to support the other departments of the institution, giving students a background in the science of genetics. The graduate program is designed to train scientists for research and teaching careers in basic genetics and in its applications in plant and animal breeding.

The Department of Genetics is housed in Gardner Hall.

UNDERGRADUATE CURRICULUM

The faculty does not have a program leading to the Bachelor of Science degree.

GRADUATE STUDY

Graduate study is carried out under the direction of any of the members of the genetics faculty and enables the student to qualify for the Master of Science or the Doctor of Philosophy degree. A candidate for the master's degree must acquire a thorough understanding of genetics and its relation to other biological disciplines and must present a thesis based upon his own research. In addition to a comprehensive knowledge of his field, a candidate for the doctorate must demonstrate his capacity for independent investigation and scholarship in genetics.

The basic aspects of quantitative genetics, cytogenetics, physiological genetics and mutation genetics as related to past and future evolution of organisms is the central theme of the training program and research. Programs of research in biochemical genetics utilize microorganisms in the basic studies of genetic phenomena and gene action. The varied but coordinated interests of the genetics faculty

* On leave.

with their research programs offer a variety of opportunities for graduate student training that is found at few other institutions. Experimental studies utilize organisms ranging from microbes, mice and drosophila to trees and economic farm animals.

HORTICULTURAL SCIENCE

Professor Fred D. Cochran, *Head of the Department*

TEACHING AND RESEARCH

Professors:
M. E. Gardner, F. L. Haynes, Jr., J. M. Jenkins, Jr., C. L. McCombs, D. T. Pope

Associate Professors:
W. E. Ballinger, T. F. Cannon, G. J. Galletta, L. J. Kushman, C. H. Miller

Assistant Professors:
E. E. Chambers, F. E. Correll, A. S. Fish, Jr., W. R. Henderson, T. R. Konsler, R. A. Larson, D. C. Zeiger

Instructor:
V. H. Underwood

EXTENSION

Professor J. H. Harris, *In Charge*

Professors:
A. A. Banadyga, H. M. Covington, M. H. Kolbe

Assistant Professors:
J. W. Love, W. A. Skroch, R. J. Stadtherr

Instructors:
J. F. Brooks, G. R. Hughes, W. W. Reid

The undergraduate programs in horticultural science offer broad training in the physical and biological sciences and business, as well as a sound cultural background, to prepare students for graduate study or for diverse professional services in the fruit and vegetable crops field, in floriculture and in nursery management and landscape horticulture.

The varied climatic conditions in North Carolina make possible the production of a wide variety of horticultural crops commercially, as well as in parks and gardens. While these crops now represent an important segment of agriculture in North Carolina, further expansion will be realized with the development of adapted varieties, mechanization and intensification of cultural practices, improvement of handling and marketing methods and development of the food processing industry.

OPPORTUNITIES

Graduates in horticulture will find numerous opportunities in a wide

variety of positions in production, processing, sales and service. Among these are county extension agents; landscaping and landscape contracting; farm operators; orchard, nursery, greenhouse and flower shop managers; research, production and promotional specialists with commercial seed, floral, fertilizer, chemical, and food companies; inspectors and quality control technologists; USDA specialists; and as leaders in other phases of agricultural and industrial developments. In addition, the student may prepare himself for one of the many opportunities for graduate study.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in horticultural science can be earned in one of the three curricula: business, science, or technology, offered by the School of Agriculture and Life Sciences. Under these curricula, specialized training is offered for horticultural science majors in fruit and vegetable crops, and in floriculture, nursery management and landscape horticulture.

For the freshman year and basic requirements see pages 59-60.

Agricultural Business—The requirements of the Agricultural Business curriculum are as follows:

Group B Courses (24 Credits)

	Credits
EC 302 National Income and Economic Welfare	3
EC 401 Principles of Accounting	3
Electives	18

Group A and C Courses (6 Credits)

ENT 312 Economic Insects	3
PP 315 Plant Diseases	3

Departmental Requirements and Electives (25 Credits)

	Credits
SSC 200 Soils	4
HS 491 Senior Seminar	1
For Majors in Fruit and Vegetable Crops:	
BO 421 Plant Physiology	4
HS 421 Fruit Production	3
HS 432 Vegetable Production	3
HS 562 Post Harvest Physiology	3
Restricted Electives	7
For Majors in Floriculture, Nursery Management and Landscape Horticulture:	
HS 211, 212 Ornamental Plants	6
HS 301 Plant Propagation	3
HS 441, 442 Floriculture I and II	6
or	
HS 342, 411, 471 Landscape Gardening, Nursery Management, and Arboriculture	9
Restricted Electives	2 or 5

Agricultural Science—The requirements of the Agricultural Science curriculum are as follows for specialization in fruit and vegetable crops and ornamental crops:

Group A Courses (25 Credits)

	Credits
BO 412 General Microbiology	4
BO 421 Plant Physiology	4
CH 220 Introductory Organic Chemistry	4
ENT 312 Economic Insects	3
GN 411 Principles of Genetics	3
PP 315 Plant Diseases	3
SSC 200 Soils	4

Departmental Requirements and Electives (26 Credits)

	Credits
HS 491 Senior Seminar	1
For Majors in Fruit and Vegetable Crops:	
HS 421 Fruit Production	3
HS 432 Vegetable Production	3
HS 562 Post Harvest Physiology	3
Restricted Electives	16
For Majors in Floriculture, Nursery Management and Landscape Horticulture:	
HS 211, 212 Ornamental Plants	6
HS 301 Plant Propagation	3
SSC 341 Soil Fertility and Fertilizers	3
HS 441, 442 Floriculture I and II	6
or	
HS 411, 471 Nursery Management, Arboriculture	6
Restricted Electives	7

Agricultural Technology—The requirements of the Agricultural Technology curriculum are as follows:

Group A and B Courses (10 Credits)

	Credits
BO 421 Plant Physiology	4
GN 411 Principles of Genetics	3
PP 315 Plant Diseases	3

Group C Courses (9 Credits)

HS 301 Plant Propagation	3
SSC 341 Soil Fertility and Fertilizers	3
Electives	3

Departmental Requirements and Electives (29 Credits)

	Credits
ENT 312 Economic Insects	3
HS 491 Senior Seminar	1
For Majors in Fruit and Vegetable Crops:	
HS 421 Fruit Production	3
HS 432 Vegetable Production	3
HS 562 Post Harvest Physiology	3
Restricted Electives	16
For Majors in Floriculture, Nursery Management and Landscape Horticulture:	
HS 211, 212 Ornamental Plants	6
HS 441, 442 Floriculture I and II	6
or	
HS 342, 411, 471 Landscape Gardening, Nursery Management, and Arboriculture	9
Restricted Electives	10 or 13

GRADUATE STUDY

The Department of Horticultural Science offers the Master of Science degree and the professional degree, Master of Horticulture.

The professional degree is designed for those interested in application of current knowledge, while the Master of Science degree places emphasis on research and provides a basis for later study on the Doctor of Philosophy degree.

PLANT PATHOLOGY

Professor D. E. Ellis, *Head of the Department*

TEACHING AND RESEARCH

Professors:
J. L. Apple, Robert Aycock, C. N. Clayton, F. A. Haasis, T. T. Hebert, A. Kelman, G. B. Lucas, R. R. Nelson, L. W. Nielsen, C. J. Nusbaum, J. N. Sasser, N. N. Winstead

Visiting Professor:
F. L. Wellman

Associate Professors:
W. E. Cooper, C. S. Hodges, D. M. Kline, L. H. Person, N. T. Powell, J. P. Ross, R. T. Sherwood, D. L. Strider, Hedwig Triantaphyllou

Adjunct Assistant Professor:
G. V. Gooding

EXTENSION

Professor Howard R. Garriss, *In Charge*

Professors:
F. A. Todd, J. C. Wells

Assistant Professor:
R. D. Milholland

Undergraduate instruction in plant pathology is designed to provide introductory and advanced courses on the nature and control of plant diseases to students majoring in crop science, horticultural science, plant protection, agricultural education, and forestry, and to provide students with the fundamental training necessary for graduate study in plant pathology.

OPPORTUNITIES

Many opportunities for employment in research, extension and teaching are available to men with advanced degrees in the field of plant pathology. Openings are available for qualified men in research in the USDA, state experiment stations and in industry. The rapid development of agricultural chemicals and other methods for disease control offers numerous opportunities. See plant protection curriculum.

UNDERGRADUATE CURRICULUM

The Department of Plant Pathology cooperates in the training of plant protection majors, but does not offer a major in plant pathology at the undergraduate level.

GRADUATE STUDY

The Department of Plant Pathology offers graduate training in all phases of plant pathology leading to the degrees of Master of Science and Doctor of Philosophy.

PLANT PROTECTION MAJOR

The major in plant protection is a joint major in the Departments of Entomology, Crop Science and Plant Pathology.

Students in plant protection will be trained in the application of chemical and biological principles for the control of plant diseases, insects, and weeds. Crop losses from insects, weeds, and diseases for the past several years have been estimated in excess of 10 billion dollars annually in the United States. A knowledge of the organisms to be controlled, the products to be used and the crops to be grown is basic to any control or regulatory program.

OPPORTUNITIES

Opportunities in plant protection basically involve improving farm efficiency to meet our ever-growing need for food and fiber. About 340 chemical companies are concerned with manufacturing and formulating products for pest control. Technically trained men are needed for sales development and promotion of agricultural chemicals. Graduates are also trained to fill positions as county extension agents or as state and federal regulatory agents. This major is primarily intended for

the Bachelor of Science degree. However, qualified students can go on to graduate school from this curriculum.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in plant protection is offered under the agricultural science curriculum of the School of Agriculture and Life Sciences.

For the freshman year and basic requirements see pages 59 and 60.

Agricultural Science—The requirements of the Plant Protection curriculum are as follows:

Restricted Electives from Group A (26 Credits)

	Credits
CH 221 and 223 Organic Chemistry I, Organic Chemistry II	8
or	
CH 220 and 351 Introductory Organic Chemistry, Introductory Biochemistry	7
BO 301 Plant Morphology	
or	
ZO 201 Animal Life	4
BO 412 General Microbiology	4
GN 411 The Principles of Genetics	3
SSC 200 Soils	4
Electives from Group A, B or C	3 or 4

Major Requirements and Electives (26 Credits)

	Credits
BO 421 Plant Physiology	4
ENT 312 Economic Insects	3
ENT 551 Fundamentals of Insect Control	3
CS 211 Crop Science I	3
CS 414 Weeds and Their Control	3
PP 315 Plant Diseases	3
PP 500 Advanced Plant Pathology	2
PP 501 or 502 Advanced Plant Pathology Lab	1
Electives	4

POULTRY SCIENCE

Professor H. W. GARREN, *Head of the Department*

TEACHING AND RESEARCH

Professors:
C. W. BARBER, F. R. CRAIG, E. W. GLAZENER, C. H. HILL, M. R. KARE, J. W. KELLY

Associate Professors:
W. L. BLOW, T. T. BROWN, F. W. COOK, W. E. DONALDSON

Assistant Professors:
G. A. MARTIN, D. D. PATE

EXTENSION

Associate Professor W. C. MILLS, JR., *In Charge*

Professor Emeritus: C. F. PARRISH

Professors:
W. G. ANDREWS, J. R. HARRIS

Associate Professors:
H. L. BUMGARDNER, T. B. MORRIS

Assistant Professor:
M. L. JONES

The Department of Poultry Science provides training in the principles of poultry husbandry and in such related scientific fields as nutrition, physiology, genetics and environmental response.

Through teaching, research and extension the department serves students, poultrymen and allied industries. The production of poultry has expanded rapidly in recent years to become one of the most important commodities in North Carolina. The climatic and economic conditions in North Carolina provide a sound base for the continuing expansion of poultry enterprises.

The Department of Poultry Science is located in Scott Hall.

OPPORTUNITIES

The expanding poultry industry in North Carolina and elsewhere has created more specialized positions than can be filled with the available poultry graduates. Job opportunities are varied, enabling the student to select the type of position having greatest appeal to him. Graduates hold positions as managers and field representatives for feed manufacturers, processors, hatcheries, equipment companies, biological supply houses, banks and other allied industries. They also work in communications and public relations and as teaching, extension and research specialists. A number of graduates have established their own successful poultry businesses.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in poultry science can be obtained in any of the three curricula offered by the School of Agriculture and Life Sciences.

For the freshman year and basic requirements see pages 59-60.

Agricultural Business—The requirements of the Agricultural Business curriculum are as follows:

Group A and C Courses (8 Credits)	*Credits*
ZO 421 Animal Physiology	4
CH 103 General Chemistry II	4
Group B Courses (24 Credits)	
Restricted Electives	24

Departmental Requirements (26 Credits)	*Credits*
PO 201 Poultry Production	4
PO 301 Poultry Quality Evaluation	2
PO 401 Poultry Diseases	4
PO 402 Commercial Poultry Enterprises	4
PO 490 Poultry Seminar	1 + 1
PO 404 (FS 404) Poultry Products	3
PO 521 Poultry Nutrition	3
CH 220 Introductory Organic Chemistry or	
CH 221 Organic Chemistry I	4

Agricultural Science—The requirements of the Agricultural Science curriculum are as follows:

Group A Courses (25 Credits)	*Credits*
BO 412 General Microbiology	4
CH 221 Organic Chemistry I	4
GN 411 The Principles of Genetics	3
ZO 421 Animal Physiology	4
*Electives	10

Departmental Requirements (26 Credits)	*Credits*
PO 201 Poultry Production	4
PO 401 Poultry Diseases	4
PO 490 Poultry Seminar	1 + 1
PO 404 (FS 404) Poultry Products	3
PO 520 Poultry Breeding	3
PO 521 Poultry Nutrition	3
PO 524 (ZO 524) Comparative Endocrinology	3
ZO 561 Animal Embryology	4

* Six credits may be elected from groups B and C.

Agricultural Technology—The requirements of the Agricultural Technology curriculum are as follows:

Group A and B Courses (15 Credits)

	Credits
CH 220 Introductory Organic Chemistry or	
CH 221 Organic Chemistry I	4
ZO 421 Animal Physiology	4
GN 411 The Principles of Genetics	3
BO 412 General Microbiology	4

Group C Courses (9 Credits)

Electives	9

Departmental Requirements (25 Credits)

	Credits
PO 201 Poultry Production	4
PO 301 Poultry Quality Evaluations	2
PO 401 Poultry Diseases	4
PO 402 Commercial Poultry Enterprises	4
PO 490 Poultry Seminar	1 + 1
PO 404 (FS 404) Poultry Products	3
PO 520 Poultry Breeding	3
PO 521 Poultry Nutrition	3

GRADUATE STUDY

An extensive research program is established in the Department of Poultry Science. Graduate training is provided in nutrition, physiology and genetics. If the student desires, a research problem can be developed in one of these areas with disease as an additional consideration. This department has one of the foremost laboratories in the country for researching the nutritional aspects of disease resistance and susceptibility. The leading laboratory in this country for studying the mechanism of taste in domestic animals is a part of the physiological research facility of this department. The genetics area enjoys a national reputation for its outstanding contributions to the science of poultry genetics. Graduate study can be developed in either physiological or population genetics.

PRE-VETERINARY

A pre-veterinary curriculum is offered as part of a working agreement with two Southern veterinary colleges. After the completion of the prescribed work, eight North Carolina students are selected each year to attend the University of Georgia and six to attend the Veterinary College at Oklahoma State University at in-state rather than out-of-state tuition rates.

If three years are spent in the pre-veterinary curriculum at North Carolina State, some course credits may be transferred from the veterinary program toward the completion of a Bachelor of Science degree from North Carolina State with a major in animal science, poultry science or zoology. Arrangements for this procedure are made prior to entrance into the veterinary school.

CURRICULUM

The pre-veterinary program is offered under the agricultural science curriculum of the School of Agriculture and Life Sciences.

Agricultural Science—The courses listed below are minimum requirements for all students applying for entrance to veterinary school

under the Southern Regional Education Board contract. Only those students who complete the required courses successfully (grade C or better on each) will be considered eligible to apply. A 2.5 grade point average on required courses is the minimum that the North Carolina Veterinary Selection Committee will recommend for attending any veterinary school.

Languages (9 Credits)

	Credits
ENG 111, 112 English Composition	6
English Elective	3

Social Sciences and Humanities (6 Credits)

HI 261 U. S. in Western Civilization	3
PS 201, American Governmental System	3

Physical and Biological Sciences (40 to 43 Credits)

	Credits
MA 111, 112 Algebra and Trigonometry; Analytic Geometry and Calculus A	8
CH 101, 103 General Chemistry I and General Chemistry II	8
CH 221, 223 Organic Chemistry I and II	8
PY 211, 212 General Physics	8
or	
PY 221 College Physics	5
ZO 223 Comparative Anatomy	4
BS 100 General Biology	4
GN 411 Principals of Genetics	3

Applied Science and Technology Courses (12 Credits)

ANS 201 Elements of Dairy Science	4
ANS 202 Fundamentals of Animal Husbandry	4
PO 201 Poultry Production	4

RURAL SOCIOLOGY

Professor SELZ C. MAYO, *Head of the Department*

TEACHING AND RESEARCH

Reynolds Professor:
C. H. HAMILTON

Professor:
E. J. BOONE

Associate Professors:
L. W. DRABICK, G. C. MCCANN, J. N. YOUNG

Visiting Assistant Professor:
S. G. MOON

Assistant Professor:
A. C. DAVIS

EXTENSION

Professor JOHN W. CRAWFORD, *In Charge of Community Development*

Associate Professor:
C. P. MARSH

Assistant Professors:
T. N. HOBGOOD, R. W. LONG

Instructors:
J. N. COLLINS, J. U. NORWOOD

The major aim of this department is to teach students the principles and techniques for understanding human group behavior. More

specifically the department seeks: (1) to train students to become leaders in organizing rural groups and communities and in administering their programs; (2) to qualify exceptional students on the undergraduate and graduate levels for rural sociological research, teaching and extension work; (3) to solve problems in human group relations through scientific research, and (4) to extend research results to the people of the State.

The Department of Rural Sociology is housed in the 1911 Building.

OPPORTUNITIES

Graduates of this department may obtain employment as community organization specialists, county agents, social welfare workers, social statisticians, administrators and managers of both public and private social agencies, college teachers, research workers and many other capacities.

Among the institutions offering employment to graduates are Land-Grant colleges, agricultural experiment stations, and extension services; the United States Departments of Agriculture, State, and Health, Education and Welfare; state departments of welfare, health and education; farm journals and newspapers; voluntary social agencies, such as Red Cross, Community Chest and Boy Scouts; and rural fraternal organizations and cooperatives. The range of vocational pursuits open to rural sociology graduates is constantly widening.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in rural sociology is offered under the agricultural science curriculum of the School of Agriculture and Life Sciences.

For the freshman year and basic requirements see pages 59 and 60.

Agricultural Science—The requirements of the agricultural science curriculum are as follows:

Group A Courses (26 Credits)

	Credits
ST 311 Introduction to Statistics	3
GN 411 Principles of Genetics, or GN 301 Genetics in Human Affairs	3
MIG 120 Physical Geology	3
*Electives	17

Departmental Requirements and Electives (26 Credits)

	Credits
RS 301 Sociology of Rural Life, or SOC 202 Principles of Sociology	3
SOC 301 Human Behavior	3
ANT 252 Cultural Anthropology	3
SOC 315 Social Thought	3
RS 321 Introduction to Social Research, or SOC 416 Research Methods	3
RS 422 Rural Social Structure, or SOC 511 Social Theory	3
Electives	8

* Six credits may be elected from Groups B and C. Additional electives from Group D.

GRADUATE STUDY

The Master of Science and the Doctor of Philosophy degrees are offered by this department. Graduate students studying for the Doc-

tor of Philosophy degree usually take approximately one semester of course work in the Department of Sociology at the University of North Carolina at Chapel Hill. Students seeking the Master of Science degree may take courses at Chapel Hill. However, they will be able to complete their entire programs at North Carolina State.

SOIL SCIENCE

Professor RALPH JOSEPH MCCRACKEN, *Head of the Department*

TEACHING AND RESEARCH

Professors:
W. V. BARTHOLOMEW, J. W. FITTS, W. A. JACKSON, E. J. KAMPRATH, J. F. LUTZ, C. B. MCCANTS, W. G. WOLTZ, W. W. WOODHOUSE, JR.

Associate Professors:
C. B. DAVEY, J. R. PILAND, P. H. REID, J. M. SPAIN, R. J. VOLK, S. B. WEED

Assistant Professors:
M. G. COOK, F. R. COX, D. L. CRAIG, G. A. CUMMINGS, E. F. GOLDSTON, R. E. MCCOLLUM, R. J. MILLER, J. E. SHELTON

Instructors:
C. P. BICKFORD, C. B. ENGLAND, R. E. HANES, R. A. LEONARD, D. L. TERRY

EXTENSION

Professor EMERSON R. COLLINS, *In Charge of Agronomy*

Associate Professor:
J. V. BAIRD

Assistant Professors:
J. F. DOGGETT, C. K. MARTIN

Instructor:
J. R. WOODRUFF

The primary objective of the Department of Soil Science is to train students in the fundamentals of soils and principles of their utilization and management. Soils constitute one of the largest capital investments in farming and proper soil management is essential for efficient production. Therefore, the demand by educational, research and service agencies and by industry for men trained in soils should continue to be great.

The Department of Soil Science is housed in Williams Hall.

OPPORTUNITIES

Soil science graduates are trained to fill positions of leadership in many areas of agricultural work, such as county extension agents; farm operators and managers; Soil Conservation Service representatives; technicians or salesmen in fertilizer companies. Provision is also made for those students who wish to obtain a more thorough

training in mathematics, chemistry, physics, and biological sciences in anticipation of graduate study. Students with advanced degrees have unlimited opportunities in teaching, research, and extension with state and federal institutions as well as increasing opportunities with commercial concerns.

UNDERGRADUATE CURRICULUM

The degree of Bachelor of Science with a major in soil science is offered under the agricultural business and agricultural science curricula of the School of Agriculture and Life Sciences. Students may also earn the degree of Bachelor of Science under the agricultural technology curriculum with a major in agronomy. The agronomy option is administered jointly by the Departments of Crop Science and Soil Science.

For the freshman year and basic requirements see pages 59-60.

Agricultural business—The requirements of the Agricultural Business curriculum are as follows:

Group B Courses (24 Credits)

	Credits
Electives	24

Group A and C Courses (6 Credits)

	Credits
Electives	6

Departmental Requirements and Electives (26 Credits)

	Credits
MIG 120 Physical Geology	3
SSC 200 Soils	4
SSC 302 Soils and Plant Growth	3
SSC 341 Soil Fertility and Fertilizers	3
SSC 452 Soil Classification	3
SSC 461 Soil Conservation and Management	3
SSC 492 Senior Seminar	1
Elective	6

Agricultural science—The requirements of the Agricultural Science curriculum are as follows:

Group A Courses (26 Credits)

	Credits
MA 201 Analytic Geometry and Calculus I	4
MA 202 Analytic Geometry and Calculus II	4
MIG 120 Physical Geology	3
BO 412 General Microbiology	4
BO 421 Plant Physiology	4
PY 212 General Physics	4
*Elective	3

Departmental Requirements and Electives (26 Credits)

	Credits
Chemistry	12
SSC 200 Soils	4
SSC 302 Soils and Plant Growth	3
SSC 341 Soil Fertility and Fertilizers	3
SSC 492 Senior Seminar	1
Select one of the following courses:	
SSC 452 Soil Classification	3
SSC 461 Soil Conservation and Management	3
SSC 472 Forest Soils	3

* May be elected from Groups B and C.

*Agricultural Technology (Agronomy)**—The requirements of the Agricultural Technology curriculum with a major in agronomy are as follows:

Physical and Biological Sciences

	Credits
BO 421 Plant Physiology	4

Group A and B Courses (10 Credits)

	Credits
CH 220 Introduction to Organic Chemistry	4
GN 411 The Principles of Genetics	3
PP 315 Plant Diseases	3

Group C Courses (10 Credits)

	Credits
Electives	10

Departmental Requirements and Electives (27 Credits)

	Credits
CS 211 Crop Science I	3
CS 312 Pastures and Forage Crops	3
CS 413 Plant Breeding	3
CS 414 Weeds and Their Control	3
SSC 302 Soils and Plant Growth or	
SSC 341 Soil Fertility and Fertilizers	3
SSC 452 Soil Classification	3
SSC 461 Soil Conservation and Management	3
SSC 492 Senior Seminar	1
Electives	5

* The agronomy major is administered by the Departments of Crop Science and Soil Science, and is listed jointly.

GRADUATE STUDY

The Department of Soil Science offers training leading to the degrees of Master of Science and Doctor of Philosophy in the following fields: soil chemistry, soil fertility, soil physics, soil genesis, soil microbiology, soil mineralogy, forest soils and soil management.

ZOOLOGY

Professor B. S. MARTOF, *Head of the Department*

TEACHING AND RESEARCH

Professors:
F. S. BARKALOW, JR., D. S. GROSCH, R. HARKEMA, D. W. HAYNE, M. R. KARE, R. W. STACY, T. L. QUAY

Adjunct Professor:
T. R. RICE

Professor Emeritus:
B. B. BRANDT

Associate Professors:
W. W. HASSLER, F. E. HESTER, L. E. METTLER, G. C. MILLER, J. A. SANTOLUCITO

Assistant Professors:
C. W. ALLISTON, J. BERGER, D. B. HORTON, R. E. LUBOW

Visiting Assistant Professor:
O. MALLER

The Department of Zoology provides undergraduate and graduate instruction in many specialized areas of the biological sciences. Undergraduates are encouraged to study all levels of biological organization from the molecular to the community. Students majoring in the de-

partment are adequately prepared for graduate work in zoology and related fields of science. Participation in supervised programs of research is strongly encouraged. Basic training is also available for students planning to enter dentistry, medicine and veterinary medicine.

The Department of Zoology is housed in Gardner Hall.

OPPORTUNITIES

Students may choose to continue graduate work leading to the Master of Science and Doctor of Philosophy degrees in zoology. Numerous employment opportunities are available. Majors are qualified for many positions in the paramedical sciences, various government institutions and private industries.

UNDERGRADUATE CURRICULA

The Bachelor of Science degree with a major in the zoology department is offered under the science curriculum of the School of Agriculture and Life Sciences. For the freshman year and basic requirements see pages 59 and 60.

The requirements for admission to medical, dental and veterinary schools vary slightly from those given below in the zoology curriculum. For specific requirements you are urged to consult the catalog of those schools where you plan to apply for admission. Students majoring in fisheries can meet the requirements of either the zoology curriculum or the fishery biology curriculum.

The requirements of each curriculum are as follows:

ZOOLOGY

	Credits
ZO 201 Animal Life	4
ZO 223 Comparative Anatomy	4
ZO 421 Animal Physiology	4
GN 411 Principles of Genetics	3
CH 221, 223 Organic Chemistry	8
One year of General Physics	8
Advised electives (3 courses must be in Zoology)	29

PRE-MEDICAL AND PRE-DENTAL

ZO 201 Animal Life	4
ZO 223 Comparative Anatomy	4
ZO 421 Animal Physiology	4
GN 411 Principles of Genetics	3
CH 221, 223 Organic Chemistry	8
CH 215 Quantitative Analysis	4
One year of General Physics	8
Advised Electives (3 courses must be in Zoology)	20

FISHERY BIOLOGY AND WILDLIFE BIOLOGY

	Credits
ZO 201 Animal Life	4
ZO 221 Conservation of Natural Resources	3
ZO 223 Comparative Anatomy	4
ZO 421 Animal Physiology	4
ZO 442 General Ecology	4
ZO 480 Fishery Science	3
ZO 551 Wildlife Science	3
ZO 541 Ichthyology or ZO 552 Wildlife Science	3
CH 221, 223 Organic Chemistry	8
PY 221 or PY 211 and 212 Physics	5 or 8
Electives—One course in botany, and one in entomology. The others in botany, chemistry, entomology, genetics, mathematics or statistics	12

GRADUATE STUDY

The Department of Zoology offers to qualified students the opportunity to earn the Master of Science and the Doctor of Philosophy degrees. Students may specialize in many areas; these are indicated by the research interests of staff members: behavior, general ecology,

population dynamics, radiobiology, limnology, fisheries biology, wildlife biology, the taxonomy and ecology of parasites, comparative morphology and systematics of vertebrates, comparative physiology, endocrinology, sensory physiology and the dynamics of respiration and circulation.

THE NORTH CAROLINA AGRICULTURAL INSTITUTE

H. Brooks James, *Dean of Agriculture and Life Sciences*

Edward W. Glazener, *Director of Instruction*

James N. Young, *Assistant Director of Instruction and Director of the Agricultural Institute*

A two-year program in agriculture was approved and money was appropriated for this purpose by the 1959 General Assembly. Through action of the Board of Trustees of the Greater University, this two-year program was named the North Carolina Agricultural Institute and was approved for operation on the North Carolina State campus.

The major objective of the Agricultural Institute is to provide technical training to the individual so that he may become more productive in our agricultural society. Specifically, instruction offered by the Agricultural Institute is designed to train men and women for those jobs in agriculture and related occupations that require technicians with education beyond the high school level. An individual with this type of training should have a better income, assume a more prominent role of leadership, and become an asset to agriculture and to his community.

The instructional programs of the Agricultural Institute are organized and conducted as part of the School of Agriculture and Life Sciences' over-all resident instruction program. The Institute is an addition to, and not a substitute for, the regular degree-granting program of the School of Agriculture and Life Sciences. However, in order to provide students enrolled in the Institute with the best possible technical training, the faculty in residence for the four-year program is responsible for organizing and teaching courses offered by the Institute.

People who have training similar to that which can be obtained in the courses offered in the Agricultural Institute are in great demand by agricultural industries. As this demand changes, new courses of study will be organized. Also, programs no longer needed will be dropped. Only through such a system of addition and deletion can the Agricultural Institute meet the needs for technically-trained people in North Carolina.

OPPORTUNITIES FOR GRADUATES

Rapid technical advancement has been extremely important in

changing agriculture from a small production industry to one of the largest industries in the nation. Today the farmer uses scientifically developed seed, feed, fertilizer; does most of his work with machinery and has scientific testing to back up his management decisions. Increased production has allowed him to sell much of his production rather than just the surplus above home consumption. Farms have become larger due to these technological advances and large amounts of capital are needed to operate successfully. All of these factors bring about dependence on outside sources of information and capital for success in a modern agricultural business.

Not only the person who farms, but the hundreds of related businesses that are a vital part of agriculture today cannot operate successfully without men trained in technical skills.

ENTRANCE REQUIREMENTS

Any individual who has received a diploma from an accredited high school or has passed the high school equivalency examination administered by the State Department of Public Instruction is eligible for entry into the Agricultural Institute. Each application will be reviewed and evaluated by the Institute director before an applicant will be accepted.

PROGRAM OF STUDY

The six programs of study offered are farm machinery sales and service, general agriculture, livestock management and technology, pest control, ornamental crops technology and field crops technology.

THE AGRICULTURAL EXPERIMENT STATION

H. Brooks James, *Dean of Agriculture and Life Sciences*
R. L. Lovvorn, *Director of Research*

The Agricultural Experiment Station was established in accordance with an act of the General Assembly of 1877 and amended in 1955. The North Carolina General Assembly has allocated to the Station, annually, certain funds from the General Fund.

The purpose of the Agricultural Experiment Station is to study the basic laws of nature underlying agricultural enterprises and to develop methods for economic production of the highest grades of livestock, poultry, and plants on the many soil types and under the varied conditions existing in North Carolina; to study methods for the control of parasitic insects and organisms that cause serious economic losses of animals, poultry, and plants; to find and develop varieties of animals, poultry, and plants new and resistant to diseases and the changeable conditions prevailing in the State; and to perfect better marketing for all agricultural products.

The staff of the Experiment Station conducts experiments in the greenhouse and laboratories of the University and throughout the State on areas owned by farmers on 16 strategically located experimental farms and on farms rented for short periods.

The agricultural research aims, through the discovery of new facts, to improve the well-being of farmers throughout the State; to strengthen the regulatory work of the State Department of Agriculture; to develop new and necessary facts for the teaching of sound agricultural principles by vocational agricultural instructors, agricultural extension agents and agricultural instructors in the University.

The Agricultural Experiment Station staff brings to the University many experts, whose teaching in many specialized fields of agriculture assures the maintenance of curricula of high standards. It contributes much to the advanced training of students who are destined to become the leaders, teachers and investigators necessary in the maintenance of agriculture on sound and economic planes.

PUBLICATIONS

The Agricultural Experiment Station publishes many bulletins and scientific papers on results of research conducted by the staff. These are free and are sent upon request to anyone in the State.

SERVICES

The staff diagnoses and interprets many problems for the farmers of North Carolina. It holds council with farmers and others interested in the agricultural industry, presents radio programs devoted to the discussion of farming procedures, and writes many letters on more specific problems of agriculture at the request of farmers, members of garden clubs, and manufacturers of fertilizer, fungicides and insecticides. It also takes part in many of the administrative functions of the University.

COOPERATIVE AGRICULTURAL EXTENSION WORK

H. Brooks James, *Dean of Agriculture and Life Sciences*

George Hyatt, Jr., *Director of Extension*

I. O. Schaub, *Director Emeritus of Extension*

David S. Weaver, *Director Emeritus of Extension*

The Agricultural Extension Service of North Carolina State of the University of North Carolina at Raleigh is a cooperative undertaking between the U. S. Department of Agriculture, the State of North Carolina and the one hundred counties. Its work is supported by federal funds made available under the Smith-Lever Act of 1914, as amended, and by state and county appropriations.

The federal and state appropriations are used to maintain an administrative and specialist staff and to pay a portion of the salary and the travel expenses of the county extension agents who are located in each of the one hundred counties. Under this cooperative arrangement, the Agricultural Extension Service serves as the "educational arm" of the U. S. Department of Agriculture, and as the "field faculty" of the institution in the areas of agriculture and home economics.

OBJECTIVES

The primary purpose of the North Carolina Agricultural Extension Service is to take to the people of the state the latest and best information obtainable, particularly that which is related to agriculture and home economics, and help them to interpret and use this information in building a more prosperous and satisfying life.

To accomplish this purpose, the institution maintains a staff of trained specialists in each of the major subject-matter areas. These specialists work primarily with and through the county agricultural and home economics agents and their assistants in the conduct of a state-wide educational program.

This program, however, has sufficient flexibility to permit special attention to the problems, needs and interests of the people in each of the individual counties. Educational assistance is given to individuals, families, industrial processing and marketing firms, other businesses and certain organizations. This includes work with both adult men and women and with boys and girls.

In carrying out this educational program, a variety of methods and devices are employed. These include method and result demonstrations, meetings, visits to farms, homes and businesses, organized groups of men and women and youth, tours, leaflets, pamphlets and other printed materials.

The basic source of information to be taught through this educational program is the findings and recommendations resulting from research conducted by the Experiment Stations in this and other states and by the U. S. Department of Agriculture.

School of Design

Henry L. Kamphoefner, *Dean*

The School of Design in its teaching recognizes the dangers inherent in a materialist-mechanistic civilization where there may be an over-reliance on the machine and the mechanical devices available for use in the construction of shelter. Therefore, the School gives

attention to the larger responsibility of architecture, the art of humanizing the environment. Also, the School seeks to integrate the architect as a social human being and the architect as scientist-engineer, and encourages and nurtures the architect-engineer as the coordinator of the structural dynamics in the over-all pattern of life.

While the School of Design's first aim is to serve North Carolina and the regions of the South, the students are well equipped, through the teaching of the School, to work in any region.

Because character, a profound devotion, and an absolute professional commitment are prime ingredients of any creative activity where the social responsibilities are as vital as in architecture and design, the School fosters and cultivates the integrity of the individual.

The School of Design emphasizes individual creative expression and at the same time teamwork is encouraged and developed.

The faculty members of the School of Design have been selected for their individual and diverse personal philosophies and their individual yet divergent professional qualifications. The School has brought together creative personalities willing in their teaching to subordinate their own professional interests to the interests of their students. Each School of Design faculty member gives the young student the benefit of his professional knowledge, his technical training, and his experience as a citizen.

To combat the dangers of over-specialization the school seeks to develop the personality and character of the student as a whole. The goal in the growth of the student is not only the mastery of the architectural techniques of the profession; but through the stimulation and development of the intellectual and emotional capacities together, a readiness is developed to meet the challenge of any environment.

The School of Design is intended to act as an educational center which unifies different design professions in the fundamental knowledge and methods which they share; its further intention is the education of men who will be competent within the specific demands and limitations of a particular field of design. The existence of contemporary design is considered to be a requirement of contemporary man, and the greatest purpose of contemporary design is considered to be the solution of those requirements through full use of the ingenuity and knowledge of contemporary man. Through this point of view the technical and factual aspects of design present no conflict with its philosophical and aesthetic standards.

The School of Design is comprised of the Departments of Architecture, Landscape Architecture, and Product Design.

The three professional fields have been grouped under one broad and unified study of the methods and values which are common to all designers, and they are separated only in the study of their application in the work of a single profession. Many classes throughout the curricula will include students in these professional fields; and for all students the course of study is similar during the first year in order that, having become more familiar with the whole

scope of activity in design, they may then select the design profession in which they are most interested.

Training in drawing, painting, sculpture and other visual arts is conducted by specialists within the staff of the School of Design; the essential knowledge of techniques and materials is taught by this faculty and other departments of the University; and the past and present of the professions are taught by this faculty. These ingredients of design training are assimilated through their application in the design courses. Thus the student is required to increasingly combine these studies as he advances through the course so that he may achieve that comprehensive combination which is a necessity in the designer. Much of the student's work will be done in laboratory courses since design is a matter of the application of knowledge rather than its mere accumulation. From his first day in class to his last the student is asked to design, and he is counseled so that he may become a responsible professional in the broadest sense.

CURRICULA

The School of Design offers professional instruction to the undergraduate in architecture, landscape architecture, and product design. A graduate program in all three departments is projected for the future.

DEGREES

The five-year curricula offer courses of study leading to the Bachelor of Architecture, Bachelor of Landscape Architecture, and the Bachelor of Product Design.

FACILITIES

The School of Design moved to Brooks Hall, the former Hill Library, in January 1956. The new Brooks Hall is a remodeling of 28,000 square feet of floor space with a modern addition of 20,000 square feet. Construction will begin during the winter of 1964-65 on a second addition of 17,000 square feet, keeping the expanded facilities, designed to accommodate 450 students, all under one roof.

OPPORTUNITIES

State law now requires the graduate architect to work not less than three years in the offices of registered architects and to pass the four day written examination given by the North Carolina Board of Architecture before he is ready to begin his own practice. The great national boom in building construction since World War II has brought a tremendous volume of work into the offices of the South, offering many attractive positions for the architectural graduate. The architectural graduate is also qualified for positions

in certain branches of engineering, building research and teaching.

The accelerated urban growth of the twentieth century has created an unprecedented demand for landscape architects that far exceeds the production of schools. These positions exist in both public and private organizations, encompassing a range of interests from city and regional planning to residential developments. For the competent graduate advancement is rapid, and remuneration above average.

Evidence of the soundness of the course of study and the programs in design at North Carolina State is reflected by two of the School's recent graduates who have been awarded the Fellowship in Landscape Architecture to the American Academy in Rome—a prize awarded annually to any design graduate in the United States and affording two years of advanced study in Europe, providing all expenses and residence at the American Academy in Rome. Four graduates of the school have won the top academic award in Architecture, the Paris Prize, which is a scholarship worth $5,000 for a year's study in Europe.

The Department of Product Design, which took its first students in September 1958, prepares graduates to work as resident designers with the furniture manufacturers and other essential and important industries of the State. Graduates of the department are also qualified to establish offices as professional industrial designers in the major cities of the State.

ARCHITECTURE

Professors:
J. H. Cox, H. H. Harris, D. R. Stuart

Associate Professors:
G. L. Bireline, J. N. Boaz, Jerzy Glowczewski, C. H. Kahn, Brian Shawcroft

Assistant Professors:
John Hertzman, J. R. Hix, Raymond Musselwhite, Vernon Shogren, E. W. Taylor, W. R. Taylor, Lawrence Wodehouse

Instructors:
L. B. Flynn, W. C. Nichols

Librarian:
Mrs. James A. Lyons

Architecture demands a fusion of the artist's decision with competent technical judgments. If it is good architecture, the design must be the product of creative insight into the meaning of the building as an object defining spaces, and must also embody an artistic declaration of the building's meaning to men and to their advancement. At the same time architecture must be technologically feasible and economically sound, and the form and spirit of the design must survive and be strengthened by the lengthy and complicated methods by which it

is transformed into a building. Good architecture does not acknowledge that the conception of a design and its execution are opposed to each other. Instead, it joins the two so that they are realized in a single act, and subjective and conceptual choices are based on a clear and complete understanding of reality.

The training of architects must stir in them the realization that technical skill is meaningless without a guiding purpose and that practical problems they face need not be opposed to their dreams and ambitions. In arts and letters the student must learn and value the purpose of architecture; in science and engineering he must learn the principles that challenge or limit him; and in his study of architecture he must learn the fusion of science and art in buildings. Four parallel programs (architecture, art, humanities and social sciences, and science and engineering) occupy the student throughout his program of study. After its completion the student is not merely ready for the apprenticeship that precedes his becoming a qualified architect. He is prepared to ponder and evaluate the things he learns during his apprenticeship and the things he learns as his self-education continues. Thus, he can combine the practical requirements of the working profession of architecture with the even more practical desire to realize the full meaning of his profession.

ARCHITECTURE CURRICULUM

FIRST YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
DN 101 Design I	4	DN 102 Design II	4
DN 111 Descriptive Drawing I	2	DN 112 Descriptive Drawing II	2
DN 121 Technical Drawing I	2	DN 122 Technical Drawing II	2
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
MA 102 Analytic Geometry and Calculus I	4	MA 201 Analytic Geometry and Calculus II	4
MS 101 Military Science I or AS 121 Air Science I	1	MS 102 Military Science I or AS 122 Air Science I	1
Physical Education	1	Physical Education	1
	17		17

SECOND YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ARC 201 Architectural Design I	4	DN 212 Descriptive Drawing IV	2
DN 211 Descriptive Drawing III	2	EM 211 Introduction to Applied Mechanics	3
HI 245 History of European Civilization	3	HI 246 History of European Civilization	3
PY 211 General Physics	4	LAR 201 Landscape Design I	4
MS 201 Military Science II or AS 221 Air Science II	1	PY 212 General Physics	4
Physical Education	1	MS 202 Military Science II or AS 222 Air Science II	1
*Elective	3	Physical Education	1
	18		18

SUMMER REQUIREMENT

Two weeks on Historic Architecture Research.

THIRD YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ARC 301 Architectural Design II	5	ARC 300 Historic Architecture Research	2
CE 338 Structures I	4	ARC 302 Architectural Design III	5
DN 311 Advanced Descriptive Drawing I	2	CE 339 Structures II	4
DN 321 History of Design I	3	DN 312 Advanced Descriptive Drawing II	2
EM 212 Mechanics of Engineering Materials	3	DN 322 History of Design II	3
		*Elective	3
	17		19

SUMMER REQUIREMENT

Eight weeks on approved construction, office experience, or foreign travel.

FOURTH YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ARC 401 Architectural Design IV	6	ARC 402 Architectural Design V	6
ARC 421 Structural Design I	3	ARC 422 Structural Design II	3
ARC 431 Environmental Factors	3	ARC 432 Environmental Factors	3
DN 411 Advanced Descriptive Drawing III	2	DN 412 Advanced Descriptive Drawing IV	2
DN 421 History of Design III	3	DN 422 History of Design IV	3
LAR 311 Landscape Technology I	4	*Elective	3
	21		20

FIFTH YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ARC 501 Architectural Design VI	6	ARC 502 Architectural Design	8
ARC 511 Professional Practice I	2	ARC 512 Professional Practice	2
ARC 531 Structural Design III	2	ARC 532 Structural Design IV	2
DN 541 Seminar on Ideas in Design	2	*Electives	6
*Elective	3		
	15		18

* Six credits of elective will be required in the literature of English or the literature of a modern foreign language, three in the social sciences; the remaining nine, free electives. (Total credits for the Bachelor of Architecture—180.)

LANDSCAPE ARCHITECTURE

Associate Professor RICHARD A. MOORE, *Head of the Department*

Professors:
L. J. CLARKE, J. H. COX, D. R. STUART, E. G. THURLOW

Associate Professor:
G. L. BIRELINE

Assistant Professors:
JOHN HERTZMAN, RAYMOND MUSSELWHITE, R. L. PHILLIPS, JR.

Landscape architecture, beginning in ancient times, is now defined as the design of outdoor space for the benefit, protection, use and

enjoyment of people. Never before have the challenges to this profession been so great, diverse, and complex. It is to their solutions that this department is directed. One such challenge is the designed development of the earth's resources in landscapes of varying character, from coast to mountain, from desert to pasture. Unlike many art forms time is an essence of the design, and long periods are often necessary before it has grown to completion. Architectural and engineering materials are used together with plants and trees. These latter materials have a continuous cycle of growth and movement, closely coupled with the forces of nature. The profession is both an art and a science, depending at the same time upon logic and technology.

A student in the department is associated with allied fields such as architecture, engineering, painting, sculpture, horticulture, botany, geology, and ecology. In spite of the necessity for assimilation of such specialized requirements, he must possess a background from which to design. For this reason he is given a sound and thorough analysis of the past through the study of historical examples. With the rapid growth of the world's population and the increasingly intensive use of land, it is imperative that the student have both ability and clarity of purpose if he is to develop and design landscape solutions that are beautiful, useful, productive, and of continuing value.

LANDSCAPE ARCHITECTURE CURRICULUM

FIRST YEAR

Fall Semester	*Credits*
DN 101 Design I	4
DN 111 Descriptive Drawing I	2
DN 121 Technical Drawing I	2
ENG 111 Composition and Rhetoric	3
MA 111 Algebra and Trigonometry	4
MS 101 Military Science I	
or	
AS 121 Air Science I	1
Physical Education	1
	17

Spring Semester	*Credits*
DN 102 Design II	4
DN 112 Descriptive Drawing II	2
DN 122 Technical Drawing II	2
ENG 112 Composition and Reading	3
MA 112 Analytic Geometry and Calculus A	4
MS 102 Military Science I	
or	
AS 122 Air Science I	1
Physical Education	1
	17

SECOND YEAR

Fall Semester	*Credits*
ARC 201 Architectural Design I	4
BS 100 General Biology	4
DN 211 Descriptive Drawing III	2
HI 245 History of European Civilization	3
MS 201 Military Science II	
or	
AS 221 Air Science II	1
Physical Education	1
*Elective	3
	18

Spring Semester	*Credits*
DN 212 Descriptive Drawing IV	2
HI 246 History of European Civilization	3
LAR 201 Landscape Design I	4
MIG 120 Physical Geology	3
PY 221 College Physics	5
MS 202 Military Science II	
or	
AS 222 Air Science II	1
Physical Education	1
	19

THIRD YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
BO 442 General Ecology	4	DN 312 Advanced Descriptive Drawing II	2
DN 311 Advanced Descriptive Drawing I	2	DN 322 History of Design II	3
DN 321 History of Design I	3	LAR 302 Landscape Design III	5
LAR 301 Landscape Design II	5	LAR 312 Landscape Technology II	4
LAR 311 Landscape Technology I	4	*Electives	6
	18		20

SUMMER REQUIREMENT

Eight weeks on approved construction, office experience, or foreign travel.

FOURTH YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ARC 431 Environmental Factors	3	DN 412 Advanced Descriptive Drawing IV	2
DN 411 Advanced Descriptive Drawing III	2	DN 422 History of Design IV	3
DN 421 History of Design III	3	LAR 402 Advanced Landscape Design II	6
LAR 401 Advanced Landscape Design I	6	LAR 422 Landscape Technology IV	4
LAR 421 Landscape Technology III	4	*Elective	3
	18		18

FIFTH YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
DN 511 Advanced Descriptive Drawing V	2	DN 512 Advanced Descriptive Drawing VI	2
DN 541 Seminar on Ideas in Design	2	LAR 502 Urban and Regional Design II	8
LAR 501 Urban and Regional Design I	8	LAR 512 Advanced Landscape Technology II	3
LAR 511 Advanced Landscape Technology I	4	*Elective	3
*Elective	3		16
	19		

* Six credits of elective will be required in the literature of English or the literature of a modern foreign language; three in the social sciences; the remaining nine free electives electives. (Total credits for the Bachelor of Landscape Architecture—180.)

PRODUCT DESIGN

Professors:
W. P. Baermann, Joseph Cox, D. R. Stuart

Associate Professor:
G. L. Bireline

Assistant Professors:
Fred Eichenberger, John Hertzman, Raymond Musselwhite

Product design is an ancient art. The history of civilization can be traced by man's skill to shape his environment. Under the influence of mechanization and automation, the simple craftsman-patron relationship has evolved into a vast complex production and distribution system. Today the product or industrial designer must be cognizant of this tradition and prepared to understand all phases of our econ-

omy. The objects he designs are used in every facet of daily life, whether by housewife or computer specialist. His clients are the industries of mass production. With creative imagination, he must integrate the forces playing upon product development into a design that fulfills human needs—aesthetically, functionally, psychologically.

In preparation, product design students must acquire understanding of materials, both natural and man-made; techniques; technology and its relationship to the sciences; problems of human engineering; fulfillment of the consumer's emotional needs. Students are introduced to research methods and comparative cost problems and go on factory field trips. In studio and laboratory, they develop new products or seek improvements in old ones. Case studies enable them intuitively and creatively to apply their academic knowledge in the form of sketches, engineering drawings, models and formal reports. Emphasis is placed upon ability to communicate, visually and verbally.

The department aims to prepare graduates to undertake their profession with a sense of integrity, responsibility and dedication.

PRODUCT DESIGN CURRICULUM

FIRST YEAR

Fall Semester	*Credits*
DN 101 Design I	4
DN 111 Descriptive Drawing I	2
DN 121 Technical Drawing I	2
ENG 111 Composition and Rhetoric	3
MA 102 Analytic Geometry and Calculus I	4
MS 101 Military Science I or AS 121 Air Science I	1
Physical Education	1
	17

Spring Semester	*Credits*
DN 102 Design II	4
DN 112 Descriptive Drawing II	2
DN 122 Technical Drawing II	2
ENG 112 Composition and Reading	3
MA 201 Analytic Geometry and Calculus II	4
MS 102 Military Science I or AS 122 Air Science I	1
Physical Education	1
	17

SECOND YEAR

Fall Semester	*Credits*
DN 211 Descriptive Drawing III	2
EC 205 The Economic Process	3
HI 341 History of Technology	3
PD 201 Product Design	4
PY 211 General Physics	4
MS 201 Military Science II or AS 221 Air Science II	1
Physical Education	1
	18

Spring Semester	*Credits*
BS 100 General Biology	4
DN 212 Descriptive Drawing IV	2
PD 202 Product Design	4
PSY 200 Introduction to Psychology	3
PY 212 General Physics	4
MS 202 Military Science II or AS 222 Air Science II	1
Physical Education	1
	19

THIRD YEAR

Fall Semester	*Credits*
CH 101 General Chemistry I	4
DN 311 Advanced Descriptive Drawing I	2
EM 211 Introduction to Applied Mechanics	3
MIM 201 Structure and Property of Engineering Materials	3
PD 301 Product Design	6
	18

Spring Semester	*Credits*
CH 103 General Chemistry II	4
DN 312 Advanced Descriptive Drawing II	2
EM 212 Mechanics of Engineering Materials	3
MIM 202 Structure and Property of Engineering Materials	3
PD 302 Product Design	6
PD 322 Design Graphics and Packaging	3
	21

FOURTH YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
DN 411 Advanced Descriptive Drawing III	2	DN 412 Advanced Descriptive Drawing IV	2
PD 401 Advanced Product Design	6	PD 402 Advanced Product Design	6
PD 441 Design Analysis	2	PD 442 Design Analysis	2
PSY 300 Sensation and Perception	3	PSY 441 Human Factors in Equipment Design	3
*Electives	6	*Electives	5
	19		18

FIFTH YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
DN 511 Advanced Descriptive Drawing V	2	DN 512 Advanced Descriptive Drawing VI	2
DN 541 Seminar on Ideas in Design	2	PD 422 Office and Industrial Practice	2
PD 501 Advanced Product Design	7	PD 502 Product Design Thesis	9
*Electives	6	*Elective	3
	17		16

* Six credits of elective will be required in the literature of English or the literature of a modern foreign language, three in the social sciences, and the remaining eleven free electives. (Total credits for the Bachelor of Product Design—180.)

SCHOOL OF EDUCATION

J. BRYANT KIRKLAND, *Dean*

With the current and anticipated increase in the number of secondary school age boys and girls in North Carolina, it is necessary for the educational institutions of the State to prepare a greater number of students to be teachers in the public schools. There is a particular need for teachers in the areas of vocational agriculture, industrial arts, industrial education, mathematics and science. The School of Education graduates students who are qualified for teaching positions in these areas.

The School includes the Departments of Agricultural Education, Industrial Arts, Industrial Education, Mathematics and Science Education, Occupational Information and Guidance, Psychology, and Recreation and Park Administration.

OBJECTIVES

The primary purpose of the Departments of Agricultural Education, Industrial Arts, Industrial Education, Mathematics and Science Education is to prepare students to become teachers in the North Carolina public schools. The School of Education also offers professional education courses for students enrolled in the School of Liberal Arts who wish to become teachers of English and social studies. Sat-

isfactory completion of the curriculum requirements in any of these departments qualifies a graduate to receive an A-Grade Certificate to teach in his chosen area. The curriculum in the Department of Recreation and Park Administration is designed primarily to prepare students to become leaders of recreation programs in industry, institutions, and municipalities.

The Department of Psychology offers an undergraduate major in psychology in cooperation with the School of Liberal Arts. Courses in psychology are required in all teacher education curricula. The department also offers graduate programs in industrial psychology, experimental psychology, school psychology and human factors.

The Department of Occupational Information and Guidance provides courses for undergraduate prospective teachers and a graduate program for students preparing to become school counselors and specialists in student personnel services in institutions of higher education.

OPPORTUNITIES

Agricultural education graduates find jobs as teachers of vocational agriculture in which they conduct organized instructional programs of vocational agriculture for rural young people and adults.

Public schools employ competent industrial arts and industrial education teachers whose job is to familiarize the young people of the State, particularly those in the non-farm areas, with the available occupational opportunities which accompany an industrial expansion and to prepare these young people for entrance into the industrial occupations of their choice.

Graduates from the Department of Recreation and Park Administration secure positions as recreational leaders for municipalities, industries and institutions, while Department of Mathematics and Science graduates find jobs in public schools and industry.

Graduates from the psychology liberal arts program may continue their education in graduate school in preparing for a variety of positions in professional psychology. The department also conducts research and service activities which are of direct benefit to education, industry and government. Majors in the Department of Occupational Information and Guidance are in great demand as counselors in public schools, community colleges, industrial education centers and non-school agencies.

DEGREES

The Bachelor of Science in education is awarded to the students who complete the curricula in agricultural education, industrial arts education, industrial education, mathematics education and science education.

The School of Education also offers the Bachelor of Science in recreation and park administration.

The degree of Master of Education or the Master of Science is offered to students majoring in agricultural education, industrial arts education, industrial education, mathematics education, science education and guidance. The degree of Master of Science is also offered for psychology majors.

AGRICULTURAL EDUCATION

Professor C. C. SCARBOROUGH, *Head of the Department*

Professors Emeritus:
L. O. ARMSTRONG, J. K. COGGIN

Professor:
J. B. KIRKLAND

Adjunct Professor:
G. B. JAMES

Associate Professor:
H. E. BEAM

Research Associate Professor:
L. W. DRABICK

Assistant Professors:
C. D. BRYANT, T. R. MILLER, C. H. ROGERS

The program in agricultural education is concerned with two large areas of study—education and agriculture. It is imperative that the objectives which give major direction to the program be clearly understood. People who produce, market, and/or process agricultural commodities are in a highly technical field. Emphasis is placed upon agriculture, agricultural products and processes. The education of people who plan to educate others in the area of agriculture is somewhat different. The objectives here are educational objectives. Agricultural objectives deal with agriculture—the improvement of crops, livestock, soils, and the like. Educational objectives relate to people—bringing about growth development, and desirable change in people. The primary concern of agricultural education is with educational objectives.

Agricultural education in its broad sense, should encompass those areas of study and pursuit which would enable one to participate effectively in planning, promoting, and initiating educational programs in agriculture. Therefore, the description of a graduate in agricultural education would be more nearly an "educational leader" than an "agricultural specialist."

Every educational leader as a person is a member of a family, a member of a community, a citizen (local, state, national, and international), and a professional worker. The experiences, understandings, and abilities needed by an educational leader are not gained through class work only. His home life, community life, dormitory and social

life on the campus, all make contributions to his preparation for his work as an educational leader.

UNDERGRADUATE PROGRAM

The program in agricultural education includes education for personal development, for community living, for citizenship, for home living, and for educational leadership. These areas in the program are divided into three groups:

(1) general education

(2) technical or special education

(3) professional education

General education includes the education which everyone should have: namely, preparation for living effectively (1) with one's self, (2) with one's family, (3) in a community, (4) as a local, state, national, and world citizen, and (5) bringing to bear the knowledge of man in solving problems. The education of people should not differ fundamentally and widely in these areas.

Special, or technical education, consists of securing an understanding and ability to solve agricultural problems, with emphasis upon managerial aspects. Particular attention is given to a consideration of the impact of these problems upon the people of North Carolina. That is, "facts and figures about agriculture" will not suffice as technical education for the educational leader. A knowledge and understanding of agriculture and the ability to identify agricultural problems, make decisions, and solve problems is essential.

Professional education includes an understanding of human behavior and development. Particular attention is given to an understanding of the learning process—as it occurs and how it can be accelerated. Consideration is also given to understanding how people work together in groups, particularly in rural communities. Ability to do research in the community is essential.

GRADUATE PROGRAM

Qualified graduate students may secure a Master of Science or Master of Education degree. Interested persons should see the Graduate Catalog or write to the Department of Agricultural Education.

FACILITIES AND RESOURCES

In addition to the University facilities and resources, the administrative personnel of most of the agricultural agencies and programs have offices in Raleigh. These people often serve as valuable resource people to students in agricultural education.

AGRICULTURAL EDUCATION CURRICULUM

FRESHMAN YEAR

Fall Semester	*Credits*
AG 103 Intro. to Agri.	1
BS 100 General Biology	4
ENG 111 Composition and Rhetoric	3
ED 102 Obj. in Ag. Ed.	1
MA 111 Alg. and Trig.	4
MS 101 Military Science I	
or	
AS 121 Air Science I	1
Physical Education	1
	15

Spring Semester	*Credits*
Elective in Plant Sc.	3
ENG 112 Composition and Reading	3
MA 112 Analyt. Geom. and Calc. A.	4
ZO 201 Animal Life	4
MS 102 Military Science I	
or	
AS 122 Air Science I	1
Physical Education	1
	16

SOPHOMORE YEAR

Fall Semester	*Credits*
CH 101 Chemistry I	4
Agriculture Elective	3
PY 221 College Physics	5
EC 201 Economics	3
MS 201 Military Science II	
or	
AS 221 Air Science II	1
Physical Education	1
	17

Spring Semester	*Credits*
AGC 212 Econ. of Agriculture	3
CH 103 General Chemistry II	4
AGE 211 Farm Machinery	4
PSY 200 Intro. to Psychology	3
History elective	3
MS 202 Military Science II	
or	
AS 222 Air Science II	1
Physical Education	1
	19

JUNIOR YEAR

Fall Semester	*Credits*
AGC 311 Org. & Bus. Mgt. of Mkt. Firms	3
ED 344 Secondary Education	3
ENG. Elective in Writing	3
RS 301 Soc. of Rural Life	3
AGE 332 Farm Structures	3
Free Elective	3
	18

Spring Semester	*Credits*
Agri. Elective	3
AGC 303 Org. and Bus. Mgt. of Farms	3
ENG Elective in Speech	3
PSY 304 Educational Psy.	3
SOI 200 Soils	4
Free Elective	3
	19

SENIOR YEAR

Fall Semester	*Credits*
*ED 411 Student Teaching	6
ED 412 Teaching Adults	2
ED 413 Plan. Prog. in Ag. Ed.	2
RS 321 Intro. to Soc. Research	3
ED 420 Prin. of Guidance	2
PSY 476 Psy. of Adolescence	2
	17

Spring Semester	*Credits*
ENG Elective in Literature**	3
Biolog. Sci. Elective	3
Political Sci. Elect.	3
Elective in Fine or Applied Arts	3
Elective in Phil. or Religion	3
Free Elective	3
	18

TOTAL SEMESTER HOURS 139

* Summer Field Experience is required prior to student teaching.
** American and English Literature.

INDUSTRIAL ARTS

Professor IVAN HOSTETLER, *Head of the Department*

Associate Professor:
T. B. YOUNG

Assistant Professors:
C. A. MOELLER, R. T. TROXLER

Instructor:
J. B. FINCH

Industrial arts comprises that area of education which concerns itself with materials, processes, and products of industry. It is concerned with a study of changes made in materials to make them more useful and with problems related to these changes.

The Department of Industrial Arts at North Carolina State performs the function of preparing teachers and supervisors of industrial arts for secondary schools.

FACILITIES

The offices of the industrial arts department are located on the first floor of Tompkins Hall; the drafting room and the various laboratories are located on the ground floor. The laboratories include test and machine tool equipment for student activities involving wood, metals, plastics, ceramics, electricity and electronics, and graphic arts. A separate experimental laboratory is provided for the purpose of encouraging experimentation and applied research in all of the industrial arts areas at the advanced undergraduate and graduate levels.

OPPORTUNITIES

The graduates of the industrial arts program find excellent opportunities for employment in the public schools.

GRADUATE STUDY

Opportunities are provided for qualified students in industrial arts education to do graduate work leading to the degree of Master of Education or Master of Science. For additional information regarding graduate study, consult the Graduate School Catalog.

INDUSTRIAL ARTS EDUCATION CURRICULUM

FRESHMAN YEAR

Fall Semester	*Credits*
CH 101 General Chemistry I	4
ENG 111 Composition & Rhetoric	3
IA 100 Introduction to Industrial Arts	1
IA 102 Fundamentals of Materials & Processes	4
MA 111 Algebra and Trigonometry	4
MS 101 Military Science or AS 121 Air Science	1
Physical Education	1
	18

Spring Semester	*Credits*
ENG 112 Composition & Reading	3
IA 105 Drafting	4
IA 109 Wood Processing	4
MA 112 Analytic Geometry and Calculus	4
MS 102 Military Science or AS 122 Air Science	1
Physical Education	1
	17

SOPHOMORE YEAR

Fall Semester	*Credits*
IA 210 Metal Technology	4
PSY 200 Introduction to Psychology	3
PY 211 General Physics	4
SOC 202 Principles of Sociology	3
MS 201 Military Science or AS 221 Air Science	1
Physical Education	1
	16

Spring Semester	*Credits*
EC 205 The Economic Process	3
ENG Elective in Speech	3
IA 205 Industrial Arts Design	3
PS 201 The American Governmental System	3
PY 212 General Physics	4
MS 202 Military Science or AS 222 Air Science	1
Physical Education	1
	18

JUNIOR YEAR

Fall Semester	*Credits*
ED 344 Secondary Education	3
IA 312 Electricity-Electronics	4
PSY 304 Educational Psychology	3
ENG Elective in Writing	3
Free Electives	6
	19

Spring Semester	*Credits*
ED 422 Methods of Teaching Industrial Subjects	3
ENG Elective in Literature	3
IA 315 General Ceramics	3
IA 304 General Shop Organization	2
IA 306 Graphic Arts	4
PSY 476 Psychology of Adolescence	2
	17

SENIOR YEAR

Fall Semester	*Credits*
ED 444 Student Teaching in Industrial Subjects	6
ED 482 Curriculum Problems in Industrial Arts	2
ED 483 Instructional Aids and Devices	2
IA 465 Independent Study in Industrial Arts	3
IA 484 School Shop Planning and Equipment Selection	3
	16

Spring Semester	*Credits*
ED 420 Principles of Guidance	2
HI History Elective	3
IA 480 Modern Industries	3
*Technical Electives	9
	17

TOTAL SEMESTER HOURS 137

* To provide depth of experience in two areas of industrial arts, six additional hours are required in one area and three in another.

INDUSTRIAL EDUCATION

Professor DURWIN M. HANSON, *Head of the Department*

Professor:
J. T. NERDEN

Assistant Professors:
K. S. OLESON, T. C. SHORE, F. S. SMITH

The Department of Industrial Education offers the only curriculum in the State that prepares teachers of industrial education for the public schools. The main goal is to provide public schools with adequately trained personnel who can, in turn, help to develop a vitally needed reservoir of skilled workers and technical personnel to man

established industries as well as prepare for new industries. The curriculum is planned to provide students with broad cultural and professional backgrounds to parallel occupational experience.

Candidates for a degree must have had at least two years of successful trade or technical experience in the occupational area they wish to teach. The student who has not had this experience when he enters must fulfill the requirement before graduation either by working part of the school year or by completing the work experience after finishing the required resident courses.

CURRICULA

The Department of Industrial Education offers two four-year undergraduate curricula leading to the degree of Bachelor of Science in education. One is designed for majors in industrial education; the other for students majoring in industrial education—applied technology teaching option. Admission to applied technology teaching option is limited to students capable of demonstrating proficiency in a given applied technology, i.e., electrical, electronics, chemical, etc.

OPPORTUNITIES

Students completing the requirements of the industrial education curriculum will be prepared to teach trade and/or technical subjects in the secondary schools and area vocational technical schools. Students may also prepare for positions as industrial cooperative training coordinators in secondary schools.

The applied technology teaching option graduates are qualified to become instructors of technical subjects in post-high school industrial technical curricula which may be offered by technical institutes, community colleges, area vocational schools and similar institutions.

GRADUATE STUDY

General and specialized professional courses are available to qualified students who wish to pursue graduate study as industrial education teachers, supervisors or coordinators of industrial cooperative training. The completion of the Master of Education or Master of Science degree with a major in industrial education will also qualify one for a graduate certificate in North Carolina.

* INDUSTRIAL EDUCATION CURRICULUM

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ED 100 Introduction to Industrial Education	2	History Elective	3
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
MA 111 Algebra and Trigonometry	4	MA 112 Analytic Geometry and Calculus	
CH 101 General Chemistry I	4	or	
MS 101 Military Science I		MA 122 Mathematics of Finance and Elementary Statistics	4
or		IA 105 Drafting	4
AS 121 Air Science I	1	MS 102 Military Science I	
Physical Education	1	or	
	—	AS 122 Air Science I	1
	15	Physical Education	1
			—
			16

SOPHOMORE YEAR

Fall Semester	*Credits*
PY 211 General Physics	4
ENG English Elective	3
PSY 200 Introduction to Psychology	3
PS 201 American Government System	3
MS 201 Military Science II	
or	
AS 221 Air Science II	1
Physical Education	1
*Elective	3
	18

Spring Semester	*Credits*
PY 212 General Physics	4
SOC 202 Principles of Sociology	3
EC 205 Economic Process	3
MS 202 Military Science II	
or	
AS 222 Air Science II	1
Physical Education	1
*Elective	6
	18

JUNIOR YEAR

Fall Semester	*Credits*
ED 344 Secondary Education	3
PSY 304 Educational Psychology	3
SOC 401 Human Relations in Industrial Society	3
IE 310 Industrial Safety	2
ED 327 History and Philosophy of Industrial-Technical Education	3
*Elective	4
	18

Spring Semester	*Credits*
PSY 476 Psychology of Adolescence	2
ED 305 Analysis of Technical Education Programs and Course Construction	3
RPA 333 First Aid and Safety	2
ED 422 Methods of Teaching Industrial Subjects	4
English Elective	3
*Elective	3
	17

SENIOR YEAR

Fall Semester	*Credits*
ED 440 Vocational Education	2
ED 483 Instructional Aids and Devices	2
ED 405 Industrial and Technical Education Shop and Laboratory Planning	3
ED 444 Student Teaching in Industrial Subjects	6
*Elective	4
	17

Spring Semester	*Credits*
EC 425 Industrial Management	3
EC 432 Industrial Relations	3
ED 420 Principles of Guidance	2
*Elective	9
	17

TOTAL SEMESTER HOURS 136

* Eighteen hours of elective courses must be selected in accordance with the student's area of specialization and with approval of the advisor. Remaining hours may be taken from free electives.

* INDUSTRIAL EDUCATION—APPLIED TECHNOLOGY TEACHING OPTION

FRESHMAN YEAR

Fall Semester	*Credits*
ED 100 Introduction to Industrial Education	2
CH 101 General Chemistry I	4
ENG 111 Composition and Rhetoric	3
MA 111 Algebra and Trigonometry	4
MS 101 Military Science I	
or	
AS 121 Air Science I	1
Physical Education	1
	15

Spring Semester	*Credits*
PS 201 American Governmental System	3
EC 205 The Economic Process	3
ENG 112 Composition and Reading	3
MA 102 Analytic Geometry and Calculus I	4
MS 102 Military Science I	
or	
AS 122 Air Science I	1
Physical Education	1
	15

SOPHOMORE YEAR

Fall Semester	*Credits*
PY 205 General Physics or PY 211 General Physics	4
MA 201 Analytic Geometry and Calculus II	4
ENG ... English Elective	3
MS 201 Military Science II or AS 221 Air Science II	1
Physical Education	1
ME 101 Engineering Graphics I	2
	15

Spring Semester	*Credits*
PY 208 General Physics or PY 212 General Physics	5 or 4
PSY 200 Introduction to Psychology	3
MS 202 Military Science II or AS 222 Air Science II	1
Physical Education	1
ME 102 Engineering Graphics II	1
**Electives	5 or 4
	15

JUNIOR YEAR

Fall Semester	*Credits*
SOC 202 Principles of Sociology	3
ED 327 History and Philosophy of Industrial-Technical Education	3
PSY 304 Educational Psychology	3
**Electives	6
	15

Spring Semester	*Credits*
SOC 401 Human Relations in Industrial Society	3
ED 305 Analysis of Technical Education Programs and Course Construction	3
**Electives	9
	15

SENIOR YEAR

Fall Semester	*Credits*
ED 405 Industrial-Technical Education Shop and Laboratory Planning	3
ED 422 Methods of Teaching Industrial Subjects	3
**Electives	9
	15

Spring Semester	*Credits*
ED 444 Student Teaching in Industrial Subjects	6
**Electives	9
	15

* Minimum of 120 semester hours required for graduation. Student will be expected to demonstrate proficiency in the applied technology of his choice—may be fulfilled by technical institute training or selected courses in addition to those required for the degree.

** Minimum of twenty-seven hours of elective courses must be selected from engineering, engineering sciences, physical sciences, etc. in accordance with the student's area of specialization and with approval of the advisor. Remaining hours may be taken from free electives.

MATHEMATICS AND SCIENCE EDUCATION

Professor HERBERT E. SPEECE, *Head of the Department*

Assistant Professors:
N. D. ANDERSON, H. A. SHANNON

The Department of Mathematics and Science Education offers a program for preparing undergraduate students as teachers of mathematics and science. The program is designed to provide a broad background in the natural sciences, social sciences, and humanities; depth of specialization in mathematics or an area of science; and the development of professional competencies needed by a teacher. There

is sufficient flexibility in the program to allow students to meet certification requirements in more than one teaching field and to qualify for employment in scientific and technological positions. The depth of preparation in the area of specialization will enable students to pursue a program of graduate studies.

GRADUATE PROGRAM

The graduate program in mathematics and science education, leading to the degree of Master of Science or Master of Education, is designed to provide in-service teachers with opportunity to up-date and extend their preparation in subject matter and professional education. Graduate students also may qualify for positions in supervision and as teachers in community colleges, industrial education centers, and four-year colleges. Interested persons should see the Graduate School Catalog or write to the Department of Mathematics and Science Education.

OPPORTUNITIES

The demand for well-qualified mathematics and science teachers in our schools and colleges results in excellent opportunities for graduates of the Department of Mathematics and Science Education. The rapid scientific, technological, and educational developments during the past few years have accentuated the importance of mathematics and science teaching. These recent developments have resulted in improved working conditions, salaries, and new opportunities for graduate study and professional advancement.

MATHEMATICS EDUCATION CURRICULUM

FRESHMAN YEAR

Fall Semester	*Credits*
CH 101 General Chemistry I	4
ENG 111 Composition and Rhetoric	3
History Elective	3
MA 111 Algebra and Trigonometry*	4
MS 101 Military Science I	
or	
AS 121 Air Science I	1
Physical Education	1
	16

Spring Semester	*Credits*
BS 101 General Biology	4
CH 103 General Chemistry II	4
ENG 112 Composition and Reading	3
MA 102 Analytic Geometry and Calculus I	4
MS 102 Military Science I	
or	
AS 122 Air Science I	1
Physical Education	1
	17

SOPHOMORE YEAR

Fall Semester	*Credits*
English Elective	3
MA 201 Analytic Geometry and Calculus II	4
PS 201 The Amer. Gov'tal. Systems	3
PSY 200 Introduction to Psychology	3
PY 211 General Physics**	4
MS 201 Military Science II	
or	
AS 221 Air Science II	1
Physical Education	1
	19

Spring Semester	*Credits*
EC 205 The Economic Process	3
ED 203 Introduction to Teaching	2
MA 202 Analytic Geometry and Calculus III	4
PY 212 General Physics	4
ST 361 Introduction to Statistics for Engineers I	3
MS 202 Military Science II	
or	
AS 222 Air Science II	1
Physical Education	1
	18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ED 344 Secondary Education	3	ENG Literature Elective	3
ENG 231 Basic Speaking Skills	3	MA 404 Fund. Concepts of Geometry	3
MA 403 Fund. Concepts of Algebra	3	SOC 202 Principles of Sociology	3
Math Elective	3	PSY 304 Educational Psychology	3
MU 200 Music in Cont. Life		Electives	6
or			
ART 200 Visual Arts in Cont. Life	3		18
PHI 201 Logic	3		
	18		

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ED 420 Principles of Guidance	2	MA 408 Advanced Geometry	3
ED 470 Methods of Teaching Math	3	PY 223 Astronomy and Astrophysics	3
ED 471 Student Teaching in Math	6	MA 433 History of Mathematics	3
ED 472 Dev. and Selecting Teaching Materials in Math	2	Electives	8
PSY 476 Psychology of Adolescence	2		17
	15		

TOTAL SEMESTER HOURS 138

* Students who show proficiency in Algebra and Trigonometry do not have to take MA 111.
** Students may schedule PY 205, 208 or PY 205, 206, 207 in place of the PY 211, 212 sequence.

SCIENCE EDUCATION CURRICULUM

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 101 General Chemistry I	4	BS 100 General Biology	4
ENG 111 Composition and Rhetoric	3	CH 103 General Chemistry II	4
History Elective	3	ENG 112 Composition and Reading	3
MA 111 Algebra and Trigonometry	4	MA 102 Anal. Geom. and Calc. I	
MS 101 Military Science I		or	
or		MA 112 Anal. Geom. and Calc. A	4
AS 121 Air Science I	1	MS 102 Military Science I	
Physical Education	1	or	
	16	AS 122 Air Science I	1
		Physical Education	1
			17

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MIG 120 Physical Geology	3	ED 203 Introduction to Teaching	2
PSY 200 Introduction to Psychology	3	PS 201 Amer. Gov'tal. Systems	3
PY 211 General Physics**	4	PY 212 General Physics	4
SOC 202 Principles of Sociology	3	Req. Science or Electives*	7
Req. Science or Elective*	3	MS 202 Military Science II	
MS 201 Military Science II		or	
or		AS 222 Air Science II	1
AS 221 Air Science II	1	Physical Education	1
Physical Education	1		18
	18		

JUNIOR YEAR

Fall Semester	*Credits*
EC 205 Economic Process	3
ED 344 Secondary Education	3
ENG 231 Basic Speaking Skills	3
MU 200 Music in Cont. Life or ART 200 Visual Arts in Cont. Life	3
Req. Science or Electives*	6
	18

Spring Semester	*Credits*
ENG Literature Elective	3
PSY 304 Educational Psychology	3
Req. Science or Electives*	12
	18

SENIOR YEAR

Fall Semester	*Credits*
ED 420 Principles of Guidance	2
ED 475 Methods of Teaching Science	3
ED 476 Student Teaching in Science***	6
ED 477 Dev. and Selecting Teaching Materials in Science	2
PSY 476 Psychology of Adolescence	2
	15

Spring Semester	*Credits*
ENG Elective	3
PHI 405 Foundations of Science	3
Req. Science or Electives*	12
	18

TOTAL SEMESTER HOURS 138

* In addition to required sciences, electives are to be selected for a minimum of 24 semester hours in the area of specialization.

** Students may elect to schedule PY 205, 208 or PY 205, 206, 207 in place of PY 211, 212 sequence.

*** During the fall semester of the senior year 10 weeks will be devoted to fulltime off-campus work at an approved Student Training Center and approximately 6 weeks to concentrated courses.

SCIENCE EDUCATION CURRICULUM

Requirements in Areas of Specialization

Specialization in Biology

BO 421 Plant Physiology	4
GN 411 Principles of Genetics	3
ZO 301 Animal Physiology	4
Organic Chemistry	4
Biological Science Electives	9

Specialization in Chemistry

Organic Chemistry	4
Analytical Chemistry	4
Physical Chemistry	4
MA 201 Anal. Geom. and Calculus II	4
MA 202 Anal. Geom. and Calculus III	4
Chemistry Elective	4

Specialization in Earth Science

MlG 222 Historical Geology	3
MlG 208 Physical Geography and Meterology	3
PY 223 Astronomy and Astrophysics	3
Earth Science Electives	12

Specialization in Physics

PY 223 Astronomy and Astrophysics	3
PY 407 Introduction to Modern Physics	3
MA 201 Anal. Geom. and Calculus II	4
MA 202 Anal. Geom. and Calculus III	4
Physics Electives	10

OCCUPATIONAL INFORMATION AND GUIDANCE

Professor ROY NELS ANDERSON, *Head of the Department*

Associate Professor:
C. G. MOREHEAD

The Department of Occupational Information and Guidance has been training guidance and personnel workers for more than four decades. The first master's degree was awarded in 1926. The programs

of graduate study are planned to develop a broad understanding of guidance and personnel services to be applied in various settings. It is most desirable for an applicant who wishes to specialize in guidance and personnel services to have had undergraduate course work in economics, education, psychology, sociology, or social work. Students accepted into the program are those who anticipate devoting full or part time to guidance and personnel work. Teachers, administrators and others who wish to increase their knowledge of guidance and personnel may enroll for courses as a graduate minor or for certification renewal.

Professional opportunities for placement in this field are on the increase. The department prepares students for positions as counselors in secondary schools, industrial education centers, colleges, community agencies, school or county guidance directors, rehabilitation counselors, employment counselors, placement interviewers, and personnel workers in higher education, business or industry, and state and federal government agencies. The student may specialize in one of several areas depending upon his career goals.

The Master of Education or Master of Science program includes a core of guidance and personnel courses to be selected according to the student's vocational goals. Students may select their minor from the following areas: economics, psychology, sociology and anthropology. The master's degree program of the department meets the requirements for the Counselor's Certificate issued by the North Carolina State Department of Public Instruction, as well as counselor certification in many other states.

The Department of Occupational Information and Guidance has had a contract with the Office of Vocational Rehabilitation for the training of Rehabilitation Counselors, and has been awarded five Counseling and Guidance Training Institutes under contract with the United States Office of Education as authorized by the National Defense Education Act of 1958.

PSYCHOLOGY

Professor HOWARD G. MILLER, *Head of the Department*

Professors:
K. L. BARKLEY, J. O. COOK, H. M. CORTER, S. E. NEWMAN

Associate Professors:
N. M. CHANSKY, J. C. JOHNSON, P. J. RUST

Assistant Professors:
T. S. BALDWIN, E. E. BERNARD, D. W. DREWES

Adjunct Assistant Professor:
GILBERT GOTTLIEB

The department offers a major in psychology as a part of the liberal arts undergraduate program. Information concerning that pro-

gram may be found in the School of Liberal Arts portion of this catalog.

In general, the courses in psychology are designed to promote a broad understanding of behavior as a science and to cultivate the skills which may be useful in dealing with human beings in social, educational, industrial or other situations. The department offers courses of interest to students in all schools of the University.

GRADUATE STUDY

Graduate work is offered in the Department of Psychology leading to the degree of Master of Science with options in industrial psychology, experimental psychology, school psychology, and human factors.

RECREATION AND PARK ADMINISTRATION

Professor THOMAS I. HINES, *Head of the Department*

Adjunct Professor:
R. J. ANDREWS

Associate Professor:
L. L. MILLER

Adjunct Associate Professor:
J. S. STEVENS, JR.

Assistant Professors:
ALBERT CRAWFORD, C. C. STOTT

Instructors:
HERBERT BRANTLEY, J. H. MOSES

The Department of Recreation and Park Administration provides training for students who plan to become recreation leaders in industry, municipalities, institutions and rural communities. The recreation and park profession recognizes the importance of leaders who possess the competence needed to plan and supervise effective programs. Competent leadership is the major factor affecting the scope, intensity and success of a program of organized recreation.

All students pursue the same program for the first year after which they declare an option (employee, education, public, institutional recreation or park administration) and take courses designed to meet the needs in their respective area of interest.

OPPORTUNITIES

The demand for properly trained recreation leadership has increased rapidly in recent years. The number of graduates has not been sufficient to meet the demand.

RECREATION AND PARK ADMINISTRATION CURRICULUM

FRESHMAN YEAR

Fall Semester	*Credits*
BS 100 General Biology	4
ENG 111 Composition and Rhetoric	3
MA 111 Algebra and Trigonometry	4
RPA 152 Intro. to Recreation	3
MS 101 Military Science I or AS 121 Air Science I	1
Physical Education	1
	16

Spring Semester	*Credits*
ENG 121 Composition and Reading	3
MA 122 Mathematics of Finance and Elementary Statistics	4
RPA 153 The Aquatic Program	2
SOC 202 Prin. of Sociology	3
ZO 201 Animal Life	4
MS 102 Military Science I or AS 122 Air Science I	1
Physical Education	1
	18

SOPHOMORE YEAR

Fall Semester	*Credits*
BO 214 Dendrology or ZO 212 Human Anatomy	3
EC 205 The Economic Process	3
History Elective	3
RPA 201 Playground Leadership	3
RPA 255 Social Recreation	4
MS 201 Military Science II or AS 221 Air Science II	1
Physical Education	1
	18

Spring Semester	*Credits*
ENG 215 Principles of News Writing	3
PS 201 American Government System	3
PSY 200 Intro. to Psychology	3
RPA 253 Principles of Physical Education	3
ZO 221 Conservation of Natural Resources or ZO 213 Human Physiology	3
MS 202 Military Science II or AS 222 Air Science II	1
Physical Education	1
	17

JUNIOR YEAR

Fall Semester	*Credits*
ENG 231 Basic Speaking Skills	3
RPA 333 First Aid and Safety	2
RPA 354 Personal and Community Hygiene	3
SOC 301 Human Behavior	3
*Electives within Interest Area	3
Free Electives	3
	17

Spring Semester	*Credits*
HS 342 Landscape Gardening	3
LAR 211 Intro. to Landscape Architecture	3
RPA 353 Camp Organization and Leadership	3
RPA 355 Sports in Recreation	4
*Electives within Interest Area	3
	16

SUMMER SESSION (9 weeks)

RPA 470 Supervised Practice 6

SENIOR YEAR

Fall Semester	*Credits*
RPA 415 Park Maintenance and Operation	3
RPA 471 Organizing the Recreation Program	2
RPA 472 Observation and Field Experience	2
SOC 416 Research Methods	3
*Electives within Interest Area	3
Free Electives	3
	16

Spring Semester	*Credits*
RPA 451 Facility and Site Planning	3
RPA 452 Recreation Administration	3
RPA 591 Special Problems in Recreation	3
*Electives within Interest Area	3
Free Electives	3
	15

TOTAL SEMESTER HOURS 139

* At the end of the sophomore year, a student must select an area of special interest. At least 12 semester hours of course work must be taken from the list of elective courses in the interest area.

SCHOOL OF ENGINEERING

RALPH E. FADUM, *Dean*
ROBERT G. CARSON, *Associate Dean*
W. E. ADAMS, *Coordinator of Student Affairs*

The engineer has the responsibility and the obligation to use all newly discovered knowledge in his field for the benefit of mankind. Today, a new sense of responsibility has been imposed upon the engineer by the impact of science and technology.

Engineering studies are of the utmost interest and importance to those young men and women who look to industry, engineering education, or research and development for a career. These ambitions can well be furthered by the School of Engineering through its undergraduate or graduate programs, whereby students are offered technical instruction and leadership guidance by an experienced staff of qualified engineers and educators.

The School of Engineering is organized into nine engineering departments: Chemical, Civil, Electrical, Industrial, Mechanical, Mineral Industries, Nuclear, Mechanics, and Research. Undergraduate degree programs are offered in the first eight departments listed. In addition, a new degree in Engineering Operations has been established. All the teaching departments offer advanced studies leading to a professional degree or to the master's degree. The Doctor of Philosophy program is offered in ceramic, chemical, civil, electrical, mechanical and nuclear engineering.

A Placement Office is maintained to assist graduating seniors and alumni with career development and associated problems.

It is the policy of the School of Engineering to have its curricula more than meet the standards of the Engineers' Council for Professional Development. It is the ambition of the school that these curricula and programs meet the needs of the people and industries of the State and region through effective instruction, competent research and development, and worthwhile contributions to engineering knowledge.

CURRICULA AND DEGREES

The curricula representing the study program in all the departments are so arranged that the freshman year is common to all. All entering students are assigned to the Freshman Engineering Division where each student is given advice in planning an appropriate program of study. Although the entering student may indicate a curriculum choice if he has one, he may wait until the end of his first year when he is in a better position to judge which engineering branch of study is most suited to his own interests and talents.

Bachelor of Science in Engineering

The four-year program provides education and training to meet the

needs of young people who will take their places in industry and industrial life in the fields of production, sales, application, planning and the operation of small industrial units.

The four-year curricula offer programs of study leading to a bachelor's degree in agricultural, ceramic, chemical, civil, electrical, engineering mechanics, engineering operations, geological, industrial, mechanical, metallurgical, and nuclear engineering. Aerospace engineering is an option in mechanical engineering, and construction engineering is an option in civil engineering. Graduation requirements are the satisfactory completion of all the required courses in any one curriculum and other courses which amount to approximately 140 semester credit hours. A minimum scholastic record of a "C" average is also required.

Specialized Degree

A specialized Bachelor of Science degree is also offered through a program of study in Furniture Manufacturing and Management. This four-year curriculum is offered through the Department of Industrial Engineering.

Professional Degree in a Specialized Branch of Engineering

The professional degree in a specialized branch of engineering is an earned degree which can be obtained only after the bachelor's degree.

The fifth-year curricula are especially designed to meet the needs of students desiring intensive specialization in a particular field or additional course work not ordinarily covered in the normal four-year undergraduate curricula. This professional program of study is offered in ceramic, chemical, civil, electrical, geological, industrial, mechanical, and metallurgical engineering.

For detailed information concerning the requirements for the professional degree, turn to page 174.

Master of Science in a Specialized Branch of Engineering

The Master of Science in a specialized branch of engineering is an earned graduate degree which can be obtained only after the bachelor's degree. It requires at least one year of graduate work, a reading knowledge of at least one foreign language and a thesis showing ability to pursue independent research. The core of graduate courses taken must emphasize a scientific objective. Further information concerning the requirements for this degree may be obtained by writing the dean of the Graduate School at North Carolina State of the University of North Carolina at Raleigh.

Doctor of Philosophy Degree

The Doctor of Philosophy degree is an earned graduate degree offered in ceramic, chemical, civil, electrical, mechanical, and nuclear engineering. Admission requirements are the same as for the master's degree. It requires at least two years of graduate work in one of these

listed major programs and a minor either in some field of engineering or in an allied science. The dissertation will deal with some problem in the field of the student's major interest. Further information concerning the degree may be obtained from the dean of the Graduate School at North Carolina State of the University of North Carolina at Raleigh.

RESEARCH

Research activities in the School of Engineering are based on a program correlated with graduate study in engineering. It is the purpose of this program not only to train future research workers, but also to carry out a program that assures both sound investigations of a fundamental nature in engineering sciences and work devoted to greater uses of the State's natural resources. Through publications, cooperative activity with industry and the operation of our own investigational projects, it is intended that the engineering research activities will be a part of and work effectively with the industrial development of North Carolina.

As part of its services to industry, the Engineering Research Department administers the Industrial Extension Service and the Minerals Research Laboratory in Asheville. Both of these operations provide technical assistance of many kinds to the industries of the State.

SHORT COURSES AND INSTITUTES

The School of Engineering offers short courses and institutes both on the campus and at various centers throughout the State for adults and graduate engineers. Such courses vary in length from one day to twelve weeks; each year the courses offered are different and vary according to the public demand. The faculty of the School of Engineering usually furnish a large portion of the instruction offered in these courses.

These short courses offer real opportunity to practicing engineering personnel to follow a refresher program in their field of interest, as well as to become acquainted with the latest and most modern engineering procedures and equipment.

Another educational services activity is that being carried out at the Gaston Technical Institute, Gastonia, North Carolina, where a two-year post-high school terminal technician program is sponsored by the School of Engineering and operated by the Division of General Extension. A separate full-time staff is employed for this educational program which provides an integrated curriculum in English, mathematics, engineering drawing, machine shop, welding, electrical maintenance, and economics. Graduates of this program are trained for industry with the opportunity for rapid acceleration towards positions as foremen, maintenance supervisors, etc. (This Institute will become a part of the Gaston Community College about July, 1965.)

HUMANITIES

Social Studies Programs for Engineering Students—A specially designed sequence of courses comprising 21 credit hours is required of all engineering students and is incorporated in each curriculum. Its primary objective is to broaden the student in the humanities and social sciences and to instill good habits in the use of the English language. Following a broad yet basic consideration of history, economics, and literature, the student progresses to an advanced and integrated study of contemporary civilization and of contemporary problems. The electives in the last year may be chosen from a group of approved courses which are built upon and closely related to the subject matter of the previous three years.

FRESHMAN YEAR

Fall Semester	*Credits*
HI 205 The Modern Western World	3

* SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ENG 205 Reading for Discovery or EC 205 The Economic Process	3	ENG 205 Reading for Discovery or EC 205 The Economic Process	3

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
SS 301 Science and Civilization	3	SS 302 Science and Civilization	3

** SENIOR YEAR

The student must take two courses from the following list, one of which must be SS491 or SS492.

	Credits		*Credits*
SS 491 Contemporary Issues I	3	SOC 401 Human Relations in Industrial Society	3
SS 492 Contemporary Issues II	3	PHI 395 Philosophy Analysis	3
HI 412 Recent United States History	3	EC 450 Economics Decision Processes	3
ENG 468 Major American Writers	3	GN 301 Genetics in Human Affairs	3
PS 401 American Parties and Pressure Groups	3		

Courses from the approved list of senior electives will not be credited to the humanities sequence unless taken during the senior year.

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* History, economics, and literature may be scheduled in any order except that ENG 111, 112, Composition, are prerequisites for ENG 205. Only one course can be scheduled in a given semester without special permission.

** The student must take either SS 491, Contemporary Issues I, or SS 492, Contemporary Issues II. He must select an elective from the senior electives list for the other senior semester.

FRESHMAN ENGINEERING DIVISION

Professor KARL P. HANSON, *Director*

Instructors:

D. G. BASSETT, J. L. CROW, K. R. CRUMP, G. K. HILLIARD, III, P. S. NYE, E. H. STINSON, B. D. WEBB

All students in their first year in the Engineering School are required to take the same courses. The courses are listed below. This division of the School of Engineering advises all freshman students on academic affairs and arranges a program of study for each student which best suits his individual talents and permits him the greatest possibility of academic success. Although an entering student may designate the department he proposes for his major, it is not necessary for him to decide his major department until the end of his freshman year. Each September a student having earned 29 or more credits is transferred to the department of his choice.

The Freshman Engineering Division offers assistance to high schools on any problems involving engineering as a career, but its major function is that of guiding and counseling each student throughout his freshman year in the School of Engineering.

FRESHMAN YEAR IN ALL ENGINEERING CURRICULA

Fall Semester	*Credits*
CH 101 General Chemistry I or CH 105 Principles of Chemistry I	4
*ENG 111 Composition and Rhetoric	3
E 100 Introduction to Engineering	0
**MA 102 Analytic Geometry and Calculus I	4
E 101 Engineering Graphics I	2
HI 205 The Modern Western World	3
***MS 101 Military Science I or ***AS 121 Air Science I	1
***Physical Education	1
	18

Spring Semester	*Credits*
CH 103 General Chemistry II or CH 107 Principles of Chemistry II	4
*ENG 112 Composition and Reading	3
MA 201 Analytic Geometry and Calculus II	4
E 102 Engineering Graphics II	1
PY 205 General Physics	4
***MS 102 Military Science I or ***AS 122 Air Science I	1
***Physical Education	1
	18

* A minimum grade of "C" must be earned on either ENG 111 or 112, otherwise ENG 111 must be repeated. Only one of these courses may be taken in a summer session; the other must be taken in a regular semester.

** To be eligible to roster courses taught by the School of Engineering above the freshman level, an engineering student must have earned a minimum grade of "C" on MA 102.

*** Students excused from military science or air science and/or physical education will schedule equivalent credits in courses outside their department. Each freshman must take two 100 level courses in physical education. Refer to the physical education section in the description of courses in this catalog.

AGRICULTURAL ENGINEERING

Professor F. J. HASSLER, *Head of the Department*

TEACHING AND RESEARCH

Professors:
H. D. BOWEN, J. M. FORE, W. E. SPLINTER, J. W. WEAVER, JR.

Associate Professors:
E. L. HOWELL, K. A. JORDAN, C. W. SUGGS

Assistant Professors:
G. B. BLUM, JR., B. K. HUANG, E. G. HUMPHRIES, W. H. JOHNSON, D. A. LINK

Instructors:
W. F. MCCLURE, E. H. WISER, F. S. WRIGHT

Head Mechanic:
R. B. GREENE

EXTENSION

Professor H. M. ELLIS, *In Charge*

Associate Professors:
J. C. FERGUSON, R. M. RITCHIE, W. C. WARRICK

Assistant Professors:
J. W. GLOVER, R. W. WATKINS

Instructors:
R. E. SNEED, E. M. STALLINGS

Students in agricultural engineering are educated and trained to deal with the problems of agriculture that are engineering in nature. Involved are the application of scientific and engineering principles to the conservation and utilization of water and soil, the development of power and labor-saving devices for all phases of agricultural production, the design of structures and equipment for housing and handling livestock and field products, and the processing and marketing of farm products.

UNDERGRADUATE CURRICULUM

This curriculum, offered in conjunction with the School of Agriculture, is designed to develop young men capable of engineering leadership in agriculture. Emphasis is placed on basic science courses such as mathematics, physics, mechanics, biology, soils, and thermodynamics, which provide a sound background for engineering and agricultural technology. Courses in agricultural engineering are directed to those methods of thought and techniques whereby science can be applied with understanding and judgment to engineering situations in agricultural operations. General agriculture courses are provided in order that the student can better understand the agricultural industry with which he deals.

Since agricultural engineering involves two distinct technical fields —agriculture and engineering—this curriculum is a joint responsibility of the two schools and is so administered.

FACILITIES

The Department of Agricultural Engineering is housed in the Agricultural Engineering Building. This building, completed in 1960, embodies the most advanced facilities for education and research in the application of engineering to the production and processing of biological material for food and fiber. Included are offices, classrooms, laboratories, shop facilities, and space for the Agricultural Engineering Extension Service.

OPPORTUNITIES

Men trained in agricultural engineering are qualified for positions in design, development and research in public institutions and in industry, and for teaching and extension work in institutions of higher education. The curriculum also provides adequate training for postgraduate work leading to advanced degrees. Graduates in this program receive the degree of Bachelor of Science in agricultural engineering.

AGRICULTURAL ENGINEERING CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MA 202 Analytic Geometry and Calculus III	4	MA 301 Differential Equations	3
PY 208 General Physics	5	EM 200 Introduction to Mechanics	3
AGE 251 Tools and Materials	3	ENG 205 Reading for Discovery	3
EC 205 The Economic Process	3	SSC 200 Soils	4
AG 103 Introduction to Agriculture	1	BS 100 General Biology	4
Physical Education	1	Physical Education	1
MS 201 Military Science II or AS 221 Air Science II	1	MS 202 Military Science II or AS 222 Air Science II	1
	18		19

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EM 301 Solid Mechanics I	3	EM 303 Fluid Mechanics	3
AGE 361 Analytical Methods	3	ST 361 Introduction to Statistics for Engineers	3
ME 301 Engineering Thermodynamics I	3	AGE 352 Control of Environment	2
AGE 303 Energy Conversion for Agricultural Production	2	SS 302 Science and Civilization	3
SS 301 Science and Civilization	3	EE 332 Principles of Electrical Engineering II	4
EE 331 Principles of Electrical Engineering I	4	Humanities Elective	3
	18		18

SENIOR YEAR

Fall Semester	*Credits*
CE 201 Engineering Measurements	3
AGE 461 Analysis of Agricultural Production Systems	3
AGE 453 Bioengineering Parameters	2
AGE 491 Electrotechnology for Agricultural Production	3
SS 491 or 492 Contemporary Issues	3
Free Elective	3
	17

Spring Semester	*Credits*
AGE 471 Soil and Water Conservation Engineering	3
AGE 462 Functional Design of Field Machines	3
AGE 481 Design of Farmstead Engineering Systems	3
PY 407 Introduction to Modern Physics	3
Free Elective	3
	15

GRADUATE STUDY

The Department of Agricultural Engineering offers programs of study for the Master of Science, Doctor of Philosophy and Master of Agricultural Engineering degrees. A bachelor's degree in agricultural engineering from an accredited curriculum or its equivalent entitles an individual to one of two approaches to graduate study. For those interested primarily in existing technologies, the Master of Agricultural Engineering program permits selections from a variety of advanced technical courses. Such study is appropriate to certain supervisory and managerial positions, technical sales, service and promotional work.

The Master of Science program takes into account the increasing rigor of modern engineering. Emphasis here is placed on mathematics and theory as the unifying link between otherwise widely divergent fields of knowledge, which are prerequisite to effective engineering advances in agricultural productions. As the student acquires competence in the advanced methods of science, he derives mathematical models for reduction of observational knowledge to engineering applications.

Study for the Doctor of Philosophy degree builds on the above Master of Science program by an additional year of formal study followed by a period of independent research to satisfy dissertation requirements.

Unusual opportunities are available for graduate student participation in departmental research programs. Current projects include: Animal Environment; Watershed Hydrology, Drainage and Irrigation; Crop Processing and Materials Handling; Field Production Operations; Fruit and Vegetable Mechanization; Pesticide Applications; Human Engineering; Systems Engineering. The systems approach to operations in crop and animal productions provides a variety of areas within which to define timely investigations.

Graduate students have access to a research shop which is manned by competent mechanics.

Information concerning fellowships and assistantships in Agricultural Engineering may be obtained from the head of the department.

CHEMICAL ENGINEERING

Professor E. M. SCHOENBORN, *Head of the Department*

Reynolds Professor:
K. O. BEATTY, JR.

Professors:
R. BRIGHT, J. K. FERRELL

Visiting Professor:
W. L. MCCABE

Associate Professors:
D. B. MARSLAND, J. F. SEELY

Assistant Professors:
D. C. MARTIN, E. P. STAHEL

Instructors:
J. H. COSGROVE, J. C. MCGEE

Chemical engineering is concerned with the design of processes, equipment and plants in which chemical and physical transformations of matter are carried out. Typical industries relying heavily upon chemical engineering include those producing chemicals, polymers, metals, drugs, glass, food, gasoline, rocket fuels, paper, soap and cement; those producing energy from nuclear fuels; and those processing materials by methods involving chemical reactions. The preparation of men qualified to pursue careers in such industries as these is the purpose of the curriculum in chemical engineering.

CURRICULUM

The work of the chemical engineer is extremely diversified and consequently his education must be along broad and basic lines. The spirit of research and experimentation is a vital part of the chemical industry and even those in the undergraduate curriculum need to acquire the sound scientific background essential to original thought and independent accomplishment. The undergraduate curriculum emphasizes the engineering, the chemical, and the economic principles involved in chemical processes and operations. The work in chemistry including inorganic, analytical, physical, and organic chemistry is comparable to that usually given to chemists with the exception of a reduction of time devoted to laboratory work. The subjects in electrical engineering, in mechanics and materials are designed to supply the fundamentals of these branches. The work in the chemical engineering subjects, although distinctly professional in application, is nevertheless basic in character. Since it depends upon a thorough background in mathematics and the sciences, it is postponed until the third and fourth years. It is designed to develop initiative, sound habits of thought and intellectual curiosity in the student.

Chemical engineers have played a major role in the atomic energy field. The future of production of nuclear fuels, the operation and design of reactors, and the processing of irradiated materials present

a multitude of chemical engineering problems. New demands of the space age will require increasing application of chemical engineering principles to the development of rocket fuels, propellants, heat shields, fuel cells, and materials for unique environments.

FACILITIES

The Chemical Engineering Laboratories are provided with pilot plant-type equipment for studying the principles of fluid flow, heat transfer, distillation, absorption, drying, crushing and grinding, filtration, agitation, etc. Much new equipment has been installed, and new and special apparatus is added from time to time to keep the facilities abreast of recent developments in the field. Emphasis is placed on the use of both digital and analog computers in the solution of typical chemical engineering problems. Special equipment for research and instructional purposes is designed and built in the departmental laboratories. In this way students are given first hand acquaintance with problems relating to the actual design, construction, and operation of typical equipment used in industry.

OPPORTUNITIES

Opportunities for employment in the chemical, atomic energy, and allied fields upon graduation are numerous and varied. Graduates find employment in such fields as research and development; production, operation, and maintenance; management and administration; inspection, testing, and process control; technical service and sales; estimation and specification writing; consulting and teaching, and many others. Students desiring to pursue careers in research and development or in teaching and consulting work are strongly advised to consider graduate training. In fact, the need for persons who have had advanced training in the field beyond the regular four-year program is continually increasing.

CHEMICAL ENGINEERING CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 221 Organic Chemistry I	4	CH 223 Organic Chemistry III	4
MA 202 Analytic Geometry and Calculus III	4	MA 301 Differential Equations I	3
PY 208 General Physics	5	CHE 205 Chemical Process Principles	4
*EC 205 The Economic Process	3	EM 200 Introduction to Mechanics	3
MS 201 Military Science II or AS 221 Air Science II	1	*ENG 205 Reading for Discovery	3
Physical Education	1	MS 202 Military Science II or AS 222 Air Science II	1
		Physical Education	1
	18		19

JUNIOR YEAR

Fall Semester	*Credits*
CH 431 Physical Chemistry I	3
CH 432 Physical Chemistry Lab.	1
CHE 311 Transport Processes I	3
EM 301 Solid Mechanics I	3
SS 301 Science and Civilization	3
MIM 201 Structure and Properties of Engineering Materials	3
Elective	3
	19

Spring Semester	*Credits*
CH 433 Physical Chemistry II	3
CHE 315 Chemical Process Thermodynamics	3
CHE 312 Transport Processes II	3
CHE 431 Chemical Engineering Lab. I	2
SS 302 Science and Civilization	3
EE 331 Principles of Electrical Engineering	4
	18

SENIOR YEAR

Fall Semester	*Credits*
CHE 427 Separation Processes I	3
CHE 432 Chemical Engineering Lab. II	2
CHE 495 Seminar	1
CHE 446 Chemical Process Kinetics	3
SS 491 Contemporary Issues	3
Elective	3
	15

Spring Semester	*Credits*
CHE 428 Separation Processes II	3
CHE 433 Chemical Engineering Lab. III	2
CH 411 Analytic Chemistry I	4
CHE 425 Process Measurement and Control	3
*Humanities Electives	3
	15

* See page 132 for information concerning the Humanities Sequence.

CIVIL ENGINEERING

Professor C. R. BRAMER, *Acting Head of the Department*

Professors:
C. SMALLWOOD, JR., M. E. UYANIK

Visiting Professor:
A. I. KASHEF

Associate Professors:
P. D. CRIBBINS, C. P. FISHER, J. W. HORN, H. E. WAHLS, PAUL ZIA*

Assistant Professors:
A. C. ALBERGA, MICHAEL AMEIN, E. P. BRANTLY*, J. F. ELY, W. S. GALLER, L. J. LANGFELDER, DONALD MCDONALD, J. B. SHULER

Instructors:
J. E. CLARK, JR., J. H. LANE, H. D. MCDONALD, D. B. STAFFORD

Civil engineering is one of the broadest of the various fields of engineering. It deals with the planning, design and construction of buildings, bridges, dams, harbor works, water works, water power facilities, sewage disposal works, nuclear waste facilities, missile launch facilities, and transportation facilities including highways, railways, waterways, airports and pipe lines. The civil engineer's services are in demand by public agencies as well as by private enterprise. The activities of the civil engineer are such that opportunities are available for office-type as well as field-type employment and for employment in small communities as well as in large industrial centers. The breadth in scope of civil engineering and the variety of

* On leave 1964-65.

types of employment open to the civil engineer are such that a student who does not have a strong predilection for some special branch of engineering may be safely advised to study civil engineering.

OBJECTIVES

It is the primary mission of the Department of Civil Engineering to offer programs of study designed to provide adequate academic preparation to those contemplating a career in the civil engineering profession. To this end, course work at both the baccalaureate and graduate levels is offered. The undergraduate program is designed to provide a sound general education and at the same time to prepare the student for advanced study in engineering either by the continuation of formal education at the graduate level or by self-study.

FACILITIES

The Department of Civil Engineering is located in Mann Hall. This building provides offices, drafting rooms and classrooms, as well as laboratory facilities for testing structural materials, soils and bituminous products, for hydraulic experiments, for studies in airphoto interpretation and photogrammetry, for analysis of structural models, for chemical and biological tests pertaining to sanitary engineering, and for the investigation of transportation problems. In addition, the facilities of Mann Hall include a student lounge and a departmental library. All of these facilities have been designed to provide for effective teaching and laboratory instruction and to create a scholarly environment.

UNDERGRADUATE CURRICULA

The Department of Civil Engineering offers two four-year undergraduate curricula: the one, leading to the degree of Bachelor of Science in civil engineering; the other, to the degree of Bachelor of Science in civil engineering, construction option. Both of these curricula have been accredited by the Engineers' Council for Professional Development.

The civil engineering curriculum is a well-balanced program of study providing academic discipline in the pure and applied physical sciences, the humanities and social sciences, and the professional aspects of civil engineering including structural, transportation and sanitary engineering, and soil mechanics and foundations.

The curriculum in civil engineering construction option is designed to suit the needs of students who are especially interested in the construction phases of civil engineering. It includes the core course requirements in the physical sciences and the social sciences and humanities as established for all engineering curricula at North Carolina State. It differs from the civil engineering curriculum in that special emphasis is given to the construction aspects of civil engineering. To this end, the curriculum includes a four-semester sequence

of courses in estimates and costs and construction planning and organization. The courses unique to this curriculum are designed to provide academic discipline in the engineering, planning and management aspects of construction.

CIVIL ENGINEERING CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*
CE 201 Engineering Measurements in Surveying	3
ENG 205 Reading for Discovery	3
MA 202 Analytic Geometry and Calculus III	4
PY 208 General Physics	5
Air or Military Science	1
Physical Education	1
	17

Spring Semester	*Credits*
EC 205 The Economic Process	3
EM 200 Introduction to Mechanics	3
MA 301 Differential Equations I	3
MIG 120 Physical Geology	3
Air or Military Science	1
Physical Education	1
Elective (Free)	3
	17

JUNIOR YEAR

Fall Semester	*Credits*
CE 331 Structural Materials I	3
EE 331 Principles of Electrical Engineering	4
EM 301 Solid Mechanics I	3
EM 303 Fluid Mechanics I	3
ME 301 Engineering Thermodynamics I	3
SS 301 Science and Civilization	3
	19

Spring Semester	*Credits*
CE 324 Structural Analysis I	3
CE 332 Structural Materials II	3
CE 342 Soil Mechanics	4
CE 382 Hydraulics	3
SS 302 Science and Civilization	3
Elective (PSAM)	3
	19

SENIOR YEAR

Fall Semester	*Credits*
CE 405 Transportation Engineering I	4
CE 421 Structural Design I	3
CE 425 Structural Analysis II	3
CE 483 Water Resources Engineering I	3
SS 491 Contemporary Issues I or SS 492 Contemporary Issues II	3
	16

Spring Semester	
CE 406 Transportation Engineering II	4
CE 422 Structural Design II	3
CE 484 Water Resources Engineering II	3
Elective in Humanities	3
Elective (Free)	3
	16

CONSTRUCTION OPTION CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*
CE 201 Engineering Measurements in Surveying	3
ENG 205 Reading for Discovery	3
MA 202 Analytic Geometry and Calculus III	4
PY 208 General Physics	5
Air or Military Science	1
Physical Education	1
	17

Spring Semester	*Credits*
EC 205 The Economic Process	3
EM 200 Introduction to Mechanics	3
MA 301 Differential Equations I	3
MIG 120 Physical Geology	3
Air or Military Science	1
Physical Education	1
Elective (Free)	3
	17

JUNIOR YEAR

Fall Semester	*Credits*
CE 331 Structural Materials I	3
CE 361 Estimates and Costs I	3
EE 331 Principles of Electrical Engineering	4
EM 301 Solid Mechanics I	3
EM 303 Fluid Mechanics I	3
SS 301 Science and Civilization	3
	19

Spring Semester	*Credits*
CE 324 Structural Analysis I	3
CE 332 Structural Materials II	3
CE 362 Estimates and Costs II	3
EC 312 Accounting for Engineers	3
SS 302 Science and Civilization	3
Elective (Technical)	3
	18

SENIOR YEAR

Fall Semester	*Credits*
CE 421 Structural Design I	3
CE 461 Project Planning and Control I	3
CE 485 Applied Hydraulics	3
ME 301 Engineering Thermodynamics I	3
SS 491 Contemporary Issues I or SS 492 Contemporary Issues II	3
Elective (Free)	3
	18

Spring Semester	*Credits*
CE 429 Structural Design III	3
CE 443 Foundations	3
CE 462 Project Planning and Control II	3
CE 464 Legal Aspects of Contracting	3
Elective in Humanities	3
	15

PROFESSIONAL STUDY IN CIVIL ENGINEERING

Fifth-year programs of study leading to the professional degree of Civil Engineer are offered in the following specialty fields; sanitary engineering, soil mechanics and foundation engineering, structural engineering and transportation engineering. The fifth-year curricula, which are made up of advanced course work, are offered as a continuation of the four-year undergraduate program and are designed for students who are desirous of becoming technically proficient in one of the specialty fields of civil engineering. The following curricula are illustrative of the fifth-year programs of study. It is to be understood, however, that a curriculum for a given student is designed in consultation with his advisor to suit his particular interests.

Regulations governing the professional program are shown on pages 174 and 175.

SANITARY ENGINEERING

Fall Semester	*Credits*
CE 571 Theory of Water and Sewage Treatment	3
CE 573 Analysis of Water and Sewage	3
CE 598 Civil Engineering Projects	2
CE 671 Advanced Water Supply and Sewerage	4
Elective	3
	15

Spring Semester	*Credits*
CE 572 Unit Operations and Processes in Sanitary Engineering	3
CE 598 Civil Engineering Projects	2
CE 672 Advanced Water and Sewage Treatment	4
Electives	6
	15

SOIL MECHANICS AND FOUNDATION ENGINEERING

Fall Semester	*Credits*
CE 524 Analysis and Design of Masonry Structures	3
CE 525 Advanced Structural Analysis I	3
CE 548 Engineering Properties of Soils I	3
CE 641 Advanced Soil Mechanics	3
Elective	3
	15

Spring Semester	*Credits*
CE 544 Foundation Engineering	3
CE 549 Engineering Properties of Soils II	3
CE 642 Advanced Soil Mechanics	3
MA 405 Introduction to Determinants and Matrices	3
Elective	3
	15

STRUCTURAL ENGINEERING

Fall Semester	*Credits*
CE 525 Advanced Structural Analysis I	3
CE 625 Advanced Structural Design I	3
EM 551 Advanced Strength of Materials	3
MA 405 Introduction to Determinants and Matrices	3
Elective	3
	15

Spring Semester	*Credits*
CE 526 Advanced Structural Analysis II	3
CE 544 Foundation Engineering	3
CE 626 Advanced Structural Design II	3
EM 552 Elastic Stability	3
Elective	3
	15

TRANSPORTATION ENGINEERING

Fall Semester	*Credits*
CE 515 Transportation Operations	3
CE 516 Transportation Design	3
CE 603 Airport Planning and Design	3
Electives	6
	15

Spring Semester	*Credits*
CE 601 Transportation Planning	3
CE 602 Advanced Transportation Design	3
CE 604 Urban Transportation Planning	3
Electives	6
	15

GRADUATE STUDY IN CIVIL ENGINEERING

The graduate degrees offered by the civil engineering department are the Master of Science in civil engineering and the Doctor of Philosophy. Facilities for research and graduate instruction are available in the areas of sanitary engineering, soil mechanics and foundation engineering, structural engineering and transportation engineering. For additional information concerning graduate study opportunities in civil engineering, the current issue of the Graduate School Catalog should be consulted.

POST-BACCALAUREATE STUDY IN CIVIL ENGINEERING RELATED TO OTHER FIELDS

Transportation Engineering and City and Regional Planning

There exists a growing need for the coordination of transportation facilities and land planning and for individuals with competence in both fields. To fulfill this need, an advanced program leading to a post-baccalaureate degree in engineering, majoring in transportation engineering, and to the degree of Master of Regional Planning is offered through the combined resources of the Department of Civil

Engineering at North Carolina State and the Department of City and Regional Planning at the University of North Carolina at Chapel Hill. Qualified students have the opportunity to schedule their courses of instruction to enable them to qualify for both advanced degrees.

The program is designed for students who are desirous of becoming technically proficient in both the fields of transportation engineering and city and regional planning. The minimum residence requirements include two academic years plus a summer internship. The curriculum includes the major core courses for both the advanced transportation engineering program and the city and regional planning program, plus supplementary courses important to both endeavors and a thesis. A bachelor's degree in engineering, including a knowledge of transportation engineering, from an institution of recognized standing is required for admission to the program. Applicants who do not meet these requirements in full may submit their credentials for examination and consideration.

Further information concerning the joint program may be obtained from the Department of Civil Engineering at North Carolina State or from the Department of City and Regional Planning at the University of North Carolina at Chapel Hill.

Water Supply and Waste Treatment

In recognition of the need by industry for personnel with training in water supply and the abatement of water pollution, the civil engineering department suggests that students in the many curricula leading to positions in industry (food processing, textile chemistry, pulp and paper technology, chemical engineering, zoology and others) consider courses of instruction in sanitary engineering for advanced undergraduate electives and for minor sequences for advanced degrees. Among the courses appropriate for such students are the following: CE 484, Water Resources Engineering II; CE 571, Theory of Water and Sewage Treatment; CE 573, Analysis of Water and Sewage; CE 673, Industrial Water Supply and Waste Disposal; and CE 674, Stream Sanitation.

ELECTRICAL ENGINEERING

Professor G. B. Hoadley, *Head of the Department*

Professors:
W. J. Barclay, A. R. Eckels, W. D. Stevenson, Jr.

Visiting Professor:
M. Itoh

Associate Professors:
N. R. Bell, A. J. Goetze, E. G. Manning, W. C. Peterson, E. W. Winkler

Assistant Professors:
R. W. Lade, N. F. J. Matthews, W. P. Seagraves

Adjunct Professors:
A. K. Hampikian, G. K. Megla, G. E. Schafer, P. G. Smith

Adjunct Associate Professor:
E. Christian

Instructors:
R. P. Connelly, W. T. Easter, D. I. Fairbanks, L. R. Herman, E. F. Hill, G. W. Hoyle, F. S. Keblawi, G. G. Reeves, A. T. Shankle, B. J. Sloan, T. B. Smiley

The purpose of the undergraduate curriculum is to train young people, either for active work in a challenging and diversified field, or for further study on the graduate level. To achieve this a thorough grounding is given in engineering science, followed by a solid foundation in fundamental electrical theory, and by advanced subject matter of sufficient breadth to insure adequate preparation for a dynamic profession. This background is essential for success, whether the particular field be automatic control, computers, communications, telemetering, electronics, the design of electrical equipment, the manufacture of electrical equipment, electric power production, the utilization of electric power, electronics in medicine, instrumentation or any other one of the vital, fast developing fields using electricity as either muscles or nerves.

CURRICULUM

The curriculum in electrical engineering includes comprehensive training in mathematics and physics—the fundamental sciences—and adequate training in allied branches of engineering. Most courses are accompanied by coordinated work in the laboratory and drill in the application of theory by means of carefully planned problems.

Each student has a choice of three courses from any of the offerings at State, and also has a choice of at least two out of nine senior elective courses in the department. Students who may be qualified for graduate study have a much wider choice and may coordinate their senior year with a plan for graduate study later. Near the end of the sophomore year, each student is asked to consider his electives and to plan a coordinated program of courses suited to his particular needs and interests.

Examinations are given each week to sophomore students in the electrical engineering course. In the junior year, examinations are given every three weeks; and in the senior year, they are given about every five weeks. This decreasing frequency of examinations is intended to encourage the student to assume more and more responsibility for the success of his own program.

FACILITIES

The Department of Electrical Engineering is housed in Daniels Hall. In addition to offices and classrooms this building provides laboratories for the study of servomechanisms and control, electronics

and communications, circuits, instrumentation, illumination, computers, and electrical machinery. There are also a student study room, a shop, and a number of research laboratories, especially in semiconductor materials and devices.

Also available to the student are the services of a digital computer for research.

GRADUATION REQUIREMENTS

Requirements for graduation are passing grades in the courses listed in the electrical engineering curriculum, passing of 140 credit hours, a grade point average of 2.00 or better, demonstration of proficiency in written English, tested in the junior year. Students receiving D grades in both ENG 111 and ENG 112 will be required to repeat ENG 111.

Attendance at two professional electrical engineering society meetings, one in the spring of the junior year and one in the fall of the senior year, is required.

Also a minimum of six continuous weeks of gainful employment is required. This employment may be as laborer, sub-professional, or professional assistant in any of the following fields: industrial manufacturing, repair service, or sales; industrial engineering or scientific research; engineering or architectural design and drafting; engineering exploration, surveying, or reconnaissance; construction of engineering works. Technical work while in military service or for a school does not satisfy this requirement. The student is responsible for obtaining his employment and supplying satisfactory evidence thereof to the department. This evidence will consist of a letter from the employer to the head of the department setting forth inclusive dates of employment; character of work performed; and an evaluation of the student's work.

STUDENT ACTIVITIES

Close coordination with the work of the professional electrical engineering societies is maintained through the IEEE Student Branch which meets twice a month. Faculty advisors assist the students in bringing to these meetings practicing engineers. The Student Branch also sponsors departmental activities such as picnics for new students and departmental participation in the Engineers' Fair.

An active chapter of Eta Kappa Nu, the national honorary electrical engineering fraternity, undertakes numerous important projects in addition to holding two initiation banquets yearly.

ELECTRICAL ENGINEERING CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MA 202 Analytic Geometry and Calculus III	4	MA 301 Differential Equations I	3
EE 201 Elementary Circuits and Fields	4	EE 202 Elementary Circuits and Fields	4
**EC 205 The Economic Process	3	**ENG 205 Reading for Discovery	3
PY 208 General Physics II	5	EM 200 Introduction to Mechanics	3
*MS 201 Military Science II or *AS 221 Air Science II	1	MIM 201 Structure and Property of Engineering Materials I	3
*Physical Education	1	*MS 202 Military Science II or *AS 222 Air Science II	1
	18	*Physical Education	1
			18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EM 301 Solid Mechanics I	3	EM 303 Fluid Mechanics I	3
**SS 301 Contemporary Civilization	3	**SS 302 Contemporary Civilization	3
EE 301 Intermediate Circuits and Fields	4	EE 302 Intermediate Circuits and Fields	4
EE 305 Electrical Machinery	4	EE 314 Electronics	4
***Elective	3	***Elective	3
	17		17

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EE 401 Advanced Circuits and Fields	3	EE 402 Advanced Circuits and Fields	3
****EE 4XY Departmental Elective	3	****EE 4XZ Departmental Elective	3
ME 301 Thermodynamics I	3	ME 303 Thermodynamics III	3
**Senior Humanities	3	**Senior Humanities	3
EE 491 EE Senior Seminar	1	***Electives	6
	16		18

* Students excused from military or air science and/or physical education will schedule equivalent credits outside their departments.

** See page 132 for information about the Humanities Sequence.

*** One of these electives must be from the following list:
PY 407, PY 552.
Another of these electives must be from the following list:
MA 302, 401, 405, 421, 511 or ST 361.

**** Selected from EE courses of 400 or 500 level.

PROFESSIONAL DEGREE

A fifth, or professional, year of study is offered in electrical engineering as a continuation of the four-year undergraduate program. This fifth year of study offers specialized and advanced course work leading to the degree of electrical engineer. Each student taking this fifth year work has his program of courses planned to meet his individual needs. Regulations governing the professional degree are shown on pages 174 and 175.

GRADUATE STUDY

The Department of Electrical Engineering offers the Master of Science, the Master of Electrical Engineering, and the Doctor of Philosophy degrees. Graduate students in electrical engineering at first-year or master's level choose one or two areas of specialization. In the more advanced study for the doctorate a comprehensive understanding of all fields of electrical engineering is required, and specialization appears in the research problem undertaken.

Advanced courses of a general and fundamental nature, such as electric network synthesis and electromagnetic waves, are recommended for all graduate students in electrical engineering, and are required of those who plan to carry their advanced studies to the level of the doctorate. Minor sequences of study in advanced mathematics or physics are planned to fit the needs of individual students.

Recipients of graduate degrees in electrical engineering at North Carolina State are in continual demand. Alumni hold important positions in the research laboratories of industry, government, and universities; in the teaching profession; and in the administrative and engineering departments of manufacturing corporations, utility companies, and government agencies.

For further information concerning graduate study in electrical engineering, the current Graduate School Catalog should be consulted.

ENGINEERING MECHANICS

Professor P. H. McDonald, *Head of the Department*

Professors:
R. A. Douglas, A. Mitchell

Associate Professors:
M. H. Clayton, J. A. Edwards

Visiting Associate Professor:
Shou-ling Wang

Assistant Professors:
W. L. Bingham, J. F. Ely, E. D. Gurley, V. E. Holt, C. J. Maday, J. B. Walker

Instructors:
Can Akkoc, H. W. Blake, J. U. Crowder, Jr., J. H. Heinbockel, G. A. Myers, Jr.

In a large portion of the contemporary engineering world there is a distinct demand for persons whose educational background encompasses concentrated study within the broad domain of engineering science, persons with the ability to analyze as well as synthesize across-the-board modern-age complexes. Such a diversified background —which demands vigorous preparation in those disciplines concerned with macroscopic as well as microscopic behavior of matter—is provided in the curriculum administered by the Department of Engineering Mechanics.

Graduates of this interdisciplinary engineering sciences program will discover wide vistas of professional opportunity including teaching, fundamental engineering research, and applied research-development. In addition, those who desire to pursue their formal education to the master and doctoral level will find that the engineering mechanics program provides a very sound foundation for graduate study in engineering.

Aside from its own undergraduate program the department fulfills an important service function in the engineering school as a whole by providing a core of fundamental courses—in solid and fluid mechanics —for other undergraduate engineering curricula.

On the graduate level the department offers a full slate of courses covering the basic principles of generalized continuum mechanics along with the more specialized areas of solid and fluid mechanics. These courses have been designed to be useful to those who desire to concentrate in mechanics as well as those whose primary field of study requires a rigorous background in some phase of mechanics.

CURRICULUM

The undergraduate program in engineering mechanics provides concentration in solid and fluid mechanics, microscopic behavior of materials, thermodynamics and transport phenomena, electric-magnetic circuits and fields in addition to a foundation of classical and modern physics, mathematics, chemistry, and humanities-social studies.

In the senior year these diverse studies are brought to bear on typical contemporary engineering systems in which interactions of many physical phenomena must be considered. Senior elective sequences in space mechanics and systems analysis-synthesis are also available.

FACILITIES

The Department of Engineering Mechanics is housed in Riddick Laboratories Building. A well-equipped instrument shop and laboratories are available for both undergraduate and graduate studies. The department's laboratories contain instruments and apparatus which are used to demonstrate and explain the prime variables of mechanics and the phenomena in which they occur. Adequate facilities are available for individual student research projects. Special emphasis is placed on the theory of instrumentation and the use of transducers and sensors, such as accelerometers, hot wire anemometers, load cells, pressure probes, electric resistance gauges, and associated recording apparatus, to study the behavior of solids and fluids. The facility also houses a dynamics laboratory.

ENGINEERING MECHANICS CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*
EE 201 Elementary Circuits and Fields	4
ENG 205 Reading for Discovery	3
MA 202 Analytic Geometry and Calculus III	4
PY 208 General Physics	5
MS 201 Military Science II or AS 221 Air Science II	1
Physical Education	1
	18

Spring Semester	*Credits*
EE 202 Elementary Circuits and Fields	4
EC 205 The Economic Process	3
MA 301 Differential Equations	3
MIM 201 Structure and Properties of Engineering Materials	3
EM 200 Introduction to Mechanics	3
MS 202 Military Science II or AS 222 Air Science II	1
Physical Education	1
	18

JUNIOR YEAR

Fall Semester	*Credits*
EE 414 Electronics	3
EM 301 Solid Mechanics I	3
EM 303 Fluid Mechanics I	3
MA 401 Intermediate Differential Equations or ST 421 Introduction to Mathematical Statistics	3
ME 301 Engineering Thermodynamics I	3
SS 301 Contemporary Civilization	3
	18

Spring Semester	*Credits*
EM 302 Solid Mechanics II	3
EM 304 Fluid Mechanics II	3
MA 402 Topics from Advanced Calculus or ST 422 Introduction to Mathematical Statistics	3
ME 302 Engineering Thermodynamics II	3
SS 302 Contemporary Civilization	3
Elective	3
	18

SENIOR YEAR

Fall Semester	*Credits*
EM 401 Experimental Mechanics I	3
Curricula Elective (Mechanics)	3
MA 405 Introduction to Determinants and Matrices	3
ME 402 Heat and Mass Transfer	3
Elective	3
	15

Spring Semester	*Credits*
EM 402 Experimental Mechanics II	3
Curricula Elective (Mechanics)	3
SS 491 Contemporary Issues	3
Electives	6
	15

GRADUATE STUDY

The Department of Engineering Mechanics offers graduate studies leading to the Master of Science degree.

Graduate studies in mechanics include basic introductory courses in solids, fluids, and continuum mechanics. These fundamental offerings serve as the background for subsequent specialization and depth in such fields as elasticity, viscoelasticity, plasticity, vibrations, dynamics, space mechanics, and ideal, viscous, or compressible fluid flow. Additional course work in advanced topics of continuum mechanics and rheology is also available. Graduate students find supporting

courses in mathematics, physics and related engineering departments well-suited for complementing their mechanics programs.

Contemporary technical demands for mechanics graduates with advanced degrees is high in both public and private institutions, with emphasis on research and development. Strong mechanics sections are emerging in mechanical, chemical, electrical and space-related industries.

CURRICULUM IN ENGINEERING OPERATIONS

Professor R. G. CARSON, JR., *Coordinator*

Advisory Committee made up of representatives from major engineering departments concerned.

The Bachelor of Science program in Engineering Operations has been designed for students with talents and motivations in the directions of the engineering functions of production, plant operations, technical sales and the other activities needed to support the modern-day economy in an industrial society. The program has essentially the same freshman year as other engineering curricula, the same humanities-social studies stem included in other engineering programs, a grounding in the basic engineering sciences and a specialization sequence. The specialization sequence consists of eighteen semester hours spread over the junior and senior years. The student need not make a choice of his specialization sequence until his junior year. Three sequences—industrial metallurgy, industrial ceramics and production control—are available. Additional sequences may be developed in other areas from time to time.

Since this program is directed more toward industrial production than some of the other engineering programs, it includes more courses on economics, materials, processes and manufacturing controls. The junior year is offered in 1964-65 for the first time and the senior year in 1965-66. The student is to choose one of the technical elective sequences listed on page 152.

ENGINEERING OPERATIONS CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*
EC 205 Economic Process	3
PY 212 or 208 General Physics	4 (5)
MIM 201 Introduction to Engineering Materials	3
EM 211 Introduction to Applied Mechanics	3
MS 201 Military Science II or AS 221 Air Science II	1
Physical Education	1
	15

Spring Semester	*Credits*
ENG 205 Reading for Discovery	3
EC 310 Economics of the Firm	3
E 207 Graphical Communications	2
EM 212 Mechanics of Engineering Materials	3
MS 202 Military Science II or AS 222 Air Science II	1
Physical Education	1
	13

Proficiency in written expression is to be demonstrated at the beginning of the junior year. Students who fail this test will be required to take additional work in the English department and to repeat the tests.

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ME 307 Energy and Energy Transform	3	IE 328 Manufacturing Processes	3
EE 350 Electrical Applications	3	SS 302 Science and Civilization	3
SS 301 Science and Civilization	3	EC 426 Personnel Management or EC 431 Labor Problems	3
ST 361 Introduction to Statistics for Engineers I	3		
EC 312 Accounting for Engineers	3		
	15		9

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
IE 301 Engineering Economy	3	IE 420 Manufacturing Controls	3
SS 491 or 492 Contemporary Issues	3	Humanities Elective	3
EC 425 Industrial Management	3		
	9		6

ELECTIVES

Free Electives ..... 9 credits
Technical Electives .....18 credits
(one of the sequences listed below)
Total credits required 130

TECHNICAL ELECTIVE SEQUENCE

Junior Year	*F*	*S*	*Senior Year*	*F*	*S*
1. *Industrial Metallurgy:*					
MIM 331, 332 Physical Metallurgy	3	3	MIM 401, 402 Metallurgical Operations	4	4
MIM 423 Metallurgy Lab	0	1	Technical Elective	3	0
	3	4		7	4
2. *Industrial Ceramics:*					
MIC 218 Introduction to Ceramic Engineering	0	4	MIC 305 Ceramic Forming and Fabrication Processes	4	0
			MIC 306 Thermal Processing	0	4
			MIC 415 Ceramic Engineering Design	3	0
			Technical Elective	0	3
				7	7
3. *Production Control:*					
IE 332 Motion and Time Study	0	4	IE 443 Quality Control	3	0
IE 310 Industrial Safety	0	2	EC 432 Industrial Relations	3	0
			IE 343 Plant Layout and Materials Handling	0	3
			Technical Electives	0	3
	0	6		6	6

ENGINEERING RESEARCH

Professor N. W. CONNER, *Director*

Research Professors:
R. F. STOOPS, H. H. STADELMAIER

Research Associate Professors:
F. M. RICHARDSON, HAYNE PALMOUR, III

Research Associates:
K. R. BROSE, S. W. DERBYSHIRE, A. C. FRAKER, A. E. LUCIER

Visiting Research Associate Professor:
J. D. SCHOBEL

Research Assistants:
M. P. DAVIS, G. E. SCOTT, ERNEST HARRISON, JR., G. L. WINCHESTER, JR.

INDUSTRIAL EXTENSION SERVICE

Research Professor and Head:
W. C. BELL

Associate Professor:
R. L. JEWETT

Research Associates:
S. D. COWARD, J. R. HART

Chemical Engineer:
J. A. MACON

Industrial Specialists:
F. L. EARGLE, J. B. TRAVIS

MINERALS RESEARCH LABORATORY

Chief Engineer:
W. T. MCDANIEL

Ore Dressing Engineers:
R. M. LEWIS, I. REDEKER, D. F. VAN DYK

Chemical Engineer:
P. N. SALES

The Department of Engineering Research gives strong support and encouragement to the many research programs conducted within the School of Engineering. The establishment and maintenance of the top-rate Department of Engineering Research is a true sign that the University and the School of Engineering are fully aware of the contributions research makes to effective teaching.

The School of Engineering, a part of North Carolina's land-grant University, serves the industrial life of the State by offering a broad program of service and experimental aid through its Department of Engineering Research. Many State industries bring problems to the School and the association between the department and the State industries is being strengthened constantly. The department's service is further strengthened through its close cooperation with the North Carolina Department of Conservation and Development. Particular encouragement and assistance are granted investigations that give promise to new North Carolina industry.

FACILITIES

The Department of Engineering Research, established originally in 1923 as the Engineering Experiment Station, maintains laboratories and a full-time staff which devotes its time exclusively to experimental work. The department's operations are carried out in close cooperation with the administration and faculties of the teaching departments. The abilities of the various departments of engineering are combined through the department so that the complete research capacity of the School of Engineering is available for experimental work in any field. The department also acts as the administrator for the School in negotiations involving research programs done for private industry and for governmental agencies.

The Minerals Research Laboratory in Asheville is engaged in the expansion of North Carolina mineral production through facilities for the development of improved processes of mineral concentrations, or examination and appraisal, and chemical analysis.

The Industrial Extension Service was created by the 1955 General Assembly. Its objective is to provide technical assistance to the State's small industry and to promote utilization of its natural resources.

RESEARCH PROGRAMS

The faculty of the School of Engineering is engaged in a wide variety of research. Many sponsored programs have been in progress for several years and the School's potential for growth is large.

Research currently undertaken includes projects supported by the National Aeronautics and Space Administration, The Atomic Energy Commission, the State Highway Commission, the U. S. Army, Air Force and Navy. Work is also being conducted for a number of North Carolina companies on a contractural basis.

Some of the areas of research activity are ceramic materials, metallurgy, propulsion, magnetohydrodynamics, solid state devices, and heat transfer, to mention only a few.

Upon their conclusions, results of the engineering investigations are published as bulletins or reports so that the information obtained is available to the public and is contributed to the total field of technical knowledge. A complete list of the bulletins published to date, or any other information pertaining to the operation or availability of the facilities of the department, will be furnished upon request.

INDUSTRIAL ENGINEERING

Professor CLIFTON A. ANDERSON, *Head of the Department*

Professors:
R. G. CARSON, JR., J. GOLDMAN, R. W. LLEWELLYN

Visiting Professor:
R. WILLARD

Associate Professor:
R. E. Alvarez

Assistant Professors:
R. L. Cope, J. J. Harder, G. E. Tucker

Instructors:
H. A. Knappenberger, A. L. Prak

Industrial engineering is a relatively new branch of the engineering profession. It has seen its greatest growth beginning with the industrial expansion in the war years. As a college curriculum, industrial engineering is the result of a demand by industry for graduates who are trained in the fundamentals of engineering and who have acquired a knowledge of the principles involved in planning, operating, and controlling the operation of an industrial enterprise.

CURRICULUM

It is the industrial engineer's job to transform plans, specifications and blueprints into plant, equipment and personnel to create the product. He is concerned also with controls and plans for the profitable and continued operation of an existing plant.

The industrial engineering program at North Carolina State has been planned with these objectives in mind. After the first year, which is common with all other accredited branches of engineering, the curriculum develops three main areas in industrial engineering. Functions relating to the planning and production of the product itself are treated in product and process design, methods study, work measurement, operation planning and plant layout. Quantitative methods for managerial controls are studied in basic statistics, engineer economic analyses, quality control and in data processing. The third category covers the use of mathematical models of operations research which are used in decision making.

The industrial engineering curriculum has been inspected and accredited by the Engineers' Council for Professional Development.

GRADUATION REQUIREMENTS

A minimum of six weeks of continuous, gainful employment is required. This employment may be any level from laborer to supervisor. The work performed should be related to industrial activities concerned primarily with production and manufacturing, maintenance, or management control functions. The student assumes responsibility for obtaining his own employment and making arrangements with his employer to provide evidence thereof to the head of the Department of Industrial Engineering. A letter from the employer stating the extent and dates of employment, a description of work performed, and an evaluation of the student's performance is suitable evidence. In general the student should plan to take such employment between his junior and senior years.

STUDENT ACTIVITIES

Student organizations within the department include a chapter of the American Institute of Industrial Engineers. This student function has demonstrated its calibre by ranking high in the Annual Student Award every year in competition with the AIIE chapters at other institutions. Departmental and student activities of a professional and a social character are sponsored by the organization.

An active chapter of Alpha Pi Mu, the industrial engineering honor society, gives recognition to the outstanding students in the junior and senior classes. The membership annually undertakes projects of value to industrial engineering students and the department.

INDUSTRIAL ENGINEERING CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
*EC 205 Economic Process	3	*ENG 205 Reading for Discovery	3
IE 351 Product and Process Engineering	3	IE 352 Work Analysis and Design	4
MA 202 Analytic Geometry and Calculus III	4	MA 301 Differential Equations I	3
PY 208 General Physics	5	MIM 201 Struc. Prop. of Engr. Materials	3
MS 201 Military Science II or AS 221 Air Science II	1	EM 200 Introduction to Mechanics	3
Physical Education	1	MS 202 Military Science II or AS 222 Air Science II	1
		Physical Education	1
	17		18

* See page 132 for information about the Humanities Sequence.

**JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MA 335 Programming for Digital Computer	1	EC 312 Accounting for Engineers	3
EM 301 Solid Mechanics I	3	IE 353 Statistical Quality Control	3
IE 311 Engineering Project Analysis	3	Advised Elective	4
EE 331 Principles of Electrical Engineering	4	MA 405 Introduction to Determinants and Matrices	3
ST 371 Introduction to Probability and Statistics	4	EE 332 Principles of Electrical Engineering	4
SS 301 Contemporary Civilization	3	SS 302 Contemporary Civilization	3
	18		20

** Proficiency in written expression to be demonstrated at the beginning of the junior year. Students who fail this test are required to take additional work in the English department as recommended by the industrial engineering department head.

SENIOR YEAR

Fall Semester	*Credits*
IE 401 Industrial Engineering Analysis I	3
IE 421 Data Processing and Production Control Systems	3
IE 491 Senior Seminar	1
IE 453 Operation Planning and Plant Layout	3
ME 301 Engineering Thermodynamics I	3
*SS 491 Contemporary Issues or *SS 492 Contemporary Issues	3
	16

Spring Semester	*Credits*
IE 402 Industrial Engineering Analysis II	3
IE 403 Industrial Engineering Analysis III	3
Electives	6
Humanities Elective	3
	15

* See page 132 for information about the Humanities Sequence.

PROFESSIONAL STUDY

A fifth, or professional year of study is offered in industrial engineering by means of specialized and advanced course work. A student may elect a speciality area in consultation with his advisor and then develop a program of study which suits his interests. A student may specialize in production engineering, in decision-making processes as related to industrial engineering, or in administrative engineering. Typical programs in each of these areas are presented below. This fifth year of study leads to the professional degree in industrial engineering. Regulations concerning the professional program are shown on pages 174 and 175.

PRODUCTION ENGINEERING

Fall Semester	*Credits*
EC 409 Introduction to Production Costs	3
IE 515 Process Engineering	3
IE 591 Project Work	3
ST 515 Experimental Statistics for Engineers I	3
Elective	3
	15

Spring Semester	*Credits*
IE 517 Automatic Processes	3
ST 516 Experimental Statistics for Engineers II	3
IE 543 Standard Data	3
IE 546 Advanced Quality Control	3
Elective	3
	15

INDUSTRIAL ENGINEERING

Fall Semester	*Credits*
IE 505 Mathematical Programming I	3
IE 521 Control Systems and Data Processing	3
ST 421 Introduction to Mathematical Statistics	3
ST 515 Experimental Statistics for Engineers I	3
Elective	3
	15

Spring Semester	*Credits*
IE 522 Dynamics of Industrial Systems	3
IE 546 Advanced Quality Control	3
IE 607 Special Topics in Mathematical Programming	3
ST 516 Experimental Statistics for Engineers II	3
Elective	3
	15

ADMINISTRATIVE ENGINEERING

Fall Semester	*Credits*
EC 504 Principles of Cost Accounting	3
EC 525 Management Policy and Decision Making	3
IE 521 Control Systems and Data Processing	3
IE 591 Project Work	3
ST 515 Experimental Statistics for Engineers I	3
	15

Spring Semester	*Credits*
EC 505 Principles of Cost Accounting	3
EC 531 Management of Industrial Relations	3
IE 522 Dynamics of Industrial Systems	3
IE 546 Advanced Quality Control	3
ST 516 Experimental Statistics for Engineers II	3
	15

GRADUATE STUDY

For general regulations, the Graduate School Catalog should be consulted. Graduate work is offered in industrial engineering leading to the degree of Master of Science in industrial engineering.

FURNITURE MANUFACTURING AND MANAGEMENT

Any curriculum in the School of Engineering has as an aim the preparation of men capable of handling the technical problems arising in the jobs which they undertake. Where industry is already equipped with qualified engineers, the new employee with a basic engineering education can be given on-the-job training in analyzing and solving the special problems peculiar to the particular plant or industry.

In the case of the furniture industry, practically no experienced engineers exist. To be of service, the University must emphasize to a greater extent the application of engineering principles to the problems of the furniture industry. This can be done effectively only if the instructional staff is aware of the problems of the industry from direct contact and not merely from the academic discussion and the available literature. Consequently, the program has been worked out in conjunction with representatives of the manufacturers. Their viewpoint is based on a survey made among the entire membership of the Southern Furniture Manufacturers' Association. Results of the survey indicate an overwhelming interest in college training to prepare men for work in this industry.

CURRICULUM

It is the purpose of the curriculum offering the degree of Bachelor of Science in furniture manufacturing to prepare graduates for technical and, eventually, executive positions in the furniture industry. The curriculum emphasizes the application of engineering to furniture manufacturing. Related subjects covering management, labor relations, accounting, marketing and sales stress the technical as well as the human side of modern production methods and techniques.

GRADUATION REQUIREMENTS

A minimum of six weeks of continuous, gainful employment is required. This employment may be at any level from laborer to super-

visor. The work performed should be related to industrial activities concerned primarily with production and manufacturing, maintenance, or management control functions in a furniture manufacturing plant. The student assumes responsibility for obtaining his own employment and making arrangements with his employer to provide evidence thereof to the head of the industrial engineering department or the professor in charge of the furniture manufacturing and management curriculum. A letter from the employer stating the extent and dates of employment, a description of work performed, and an evaluation of the student's performance is suitable evidence. In general the student should plan to take such employment between his junior and senior years.

STUDENT ACTIVITIES

The industrial engineering department sponsors the Furniture Club, which is operated by the students. All students in the curriculum are eligible for membership in the organization. The club brings in speakers from industry and holds social gatherings for the students.

FURNITURE MANUFACTURING AND MANAGEMENT CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 220 Introduction to Organic Chemistry	4	EC 312 Accounting for Engineers	3
EC 205 The Economic Process	3	ENG 205 Reading for Discovery	3
ENG 231 Basic Speaking Skills	3	FOR 201 Wood Properties	3
PY 212 General Physics	4	IA 203 Technical Sketching	2
or		IE 224 Woodworking Equipment	2
PY 208 General Physics	5	MS 202 Military Science II	
MS 201 Military Science II		or	
or		AS 222 Air Science II	1
AS 221 Air Science II	1	Physical Education	1
Physical Education	1		15
	16 or 17		

SUMMER PRACTICUM

FOR 205-s, 206-s, 207-s, 208-s, and 209-s.....5 Credits

*JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EC 310 Economics of the Firm	3	IE 301 Engineering Economy	3
FOR 301 Wood Processes I	4	IE 326 Furniture Manufacture and Processing	4
IE 322 Furniture Design and Construction I	2	SS 302 Science and Civilization	3
IE 332 Motion and Time Study	4	ST 361 Introduction to Statistics for Engineers	3
SS 301 Science and Civilization	3	TX 271 Upholstery Fabrics	2
	16		15

SENIOR YEAR

Fall Semester	*Credits*
IE 341 Furniture Plant Layout	3
IE 420 Manufacturing Controls	5
IE 491 Seminar	1
**SS 491 Contemporary Issues	3
Advised Elective	4
Elective	3
	17

Spring Semester	*Credits*
EC 432 Industrial Relations	
or	
EC 431 Labor Problems	3
IE 443 Quality Control	3
IE 492 Seminar	1
Elective	6
Humanities Elective	3
	16

* Proficiency in written expression to be demonstrated at the beginning of the junior year. Students who fail this test are required to take additional work in the English department as recommended by the industrial engineering department head.

** See page 132 for information about the Humanities Sequence.

MECHANICAL ENGINEERING

Professor R. W. Truitt, *Head of the Department*

Professors:

N. W. Conner, J. S. Doolittle, K. P. Hanson, H. A. Hassan, R. B. Knight, R. M. Pinkerton, J. Woodburn, C. F. Zorowski

Associate Professors:

M. R. El-Saden, B. H. Garcia, M. N. Ozisik, F. O. Smetana, J. K. Whitfield, J. C. Williams, III, J. T. Yen*

Assistant Professors:

E. M. Afify, F. D. Hart, T. B. Ledbetter, H. C. Topakoglu

Instructors:

R. F. Barrett, J. P. Hartman, R. J. Parekh, L. J. Pavagadhi, C. S. Rudisill, D. W. Stallings

Engineers are motivated by a desire to satisfy human needs through the application of scientific principles in such a manner as to place the fruits of their work within the economic reach of vast segments of humanity. To identify and evaluate human needs, modern engineers must have a sound education in the basic sciences, mathematics, and the humanities. The gap between the discoveries of basic science and their application in the satisfaction of human needs is provided by an area of science known as the engineering sciences. It is with education in the engineering sciences and the development of talent in applying the principles of the engineering sciences that departments of engineering are principally concerned.

Mechanical engineering covers a broad spectrum of engineering responsibility in such areas as nuclear and conventional power generation, missiles, rockets, jet engines, propulsion systems for land, sea, and air vehicles, refrigeration, air conditioning, combustion of fuels, instrumentation of industrial processes, solar energy, and the design of a wide variety of technical systems. Aerospace engineering shares responsibility with mechanical engineering for many of the areas described above but is principally concerned with the analysis

* On leave.

and design of modern aircraft and space vehicles and with the phenomena of air and space flight.

Because of the close relationship between mechanical and aerospace engineering, both curricula are administered by the Department of Mechanical Engineering at North Carolina State. There is close cooperation between the faculties of the two disciplines in which responsibility for such engineering sciences as thermodynamics, heat and mass transfer, gas dynamics, aeroelasticity, vibrations, fluid mechanics, magnetohydrodynamics, plasmagasdynamics, aerodynamics, and instrumentation theory are shared.

CURRICULUM

The curriculum in mechanical engineering is based on a firm foundation in mathematics, physics, chemistry, humanities and social sciences. The student's knowledge in the basic engineering sciences germane to mechanical engineering is carefully developed in the courses offered in this department and other departments of the School of Engineering. Finally, the curriculum provides an active experience in which the student's creative talents and imagination are challenged in several areas of application. This experience is gained through a choice of courses in the senior year and required courses in experimental mechanical engineering.

The curriculum in aerospace engineering is administered as an option in mechanical engineering. Generally speaking, the curricula in mechanical and aerospace engineering differ slightly in the first three years. The point of departure occurs in the fourth year where the emphasis in the aerospace engineering curriculum is placed on the basic aerospace engineering sciences and the analysis and design of flight vehicles.

The four-year undergraduate curricula in both mechanical and aerospace engineering prepare graduates who are equipped to profit from their experiences in the practice of engineering and to become early contributors in the solution of engineering problems of scientific and economic complexity. Both curricula offer a firm basis for further advanced study in graduate schools.

MECHANICAL ENGINEERING CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*
*EC 205 The Economic Process	
or	
ENG 205 Reading for Discovery	3
MA 202 Analytical Geometry and Calculus III	4
ME 211 Introduction to Mechanical Engineering	3
PY 208 General Physics	5
MS 201 Military Science II	
or	
AS 221 Air Science II	1
Physical Education	1
	17

Spring Semester	*Credits*
*ENG 205 Reading for Discovery	
or	
EC 205 The Economic Process	3
EM 200 Introduction to Mechanics	3
MA 301 Differential Equations	3
ME 212 Mechanical Analysis	3
MS 202 Military Science II	
or	
AS 222 Air Science II	1
Physical Education	1
Elective	3
	17

JUNIOR YEAR

Fall Semester	*Credits*
EE 331 Principles of Electrical Engineering	4
EM 301 Solid Mechanics I	3
MA 401 Intermediate Differential Equations	
or	
MA 511 Advanced Calculus I	3
ME 301 Engineering Thermodynamics I	3
ME 305 Mechanical Engineering Laboratory I	1
ME 315 Dynamics of Machines	3
SS 301 Science and Civilization	3
	20

Spring Semester	*Credits*
EE 332 Principles of Electrical Engineering	4
EM 303 Fluid Mechanics I	3
ME 302 Engineering Thermodynamics II	3
ME 306 Mechanical Engineering Laboratory II	1
MIM 201 Structure and Properties of Engineering Materials	3
SS 302 Science and Civilization	3
	17

SENIOR YEAR

Fall Semester	*Credits*
ME 401 Energy Conversion	3
ME 405 Mechanical Engineering Laboratory III	1
ME 411 Mechanical Design I	3
ME 431 Thermo of Fluid Flow	3
SS 491 Contemporary Issues I	3
Departmental Elective	3
Elective	3
	19

Spring Semester	*Credits*
ME 402 Heat and Mass Transfer	3
ME 406 Mechanical Engineering Laboratory IV	1
ME 412 Mechanical Design II	3
ME 441 Technical Seminar	1
*SS 492 Contemporary Issues II	
or	
Elective in Humanities	3
Departmental Elective	3
	14

* See page 132 for information about the Humanities Sequence.

AEROSPACE ENGINEERING OPTION CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*
*EC 205 The Economic Process	
or	
ENG 205 Reading for Discovery	3
EE 201 Elementary Circuits and Fields	4
MA 202 Analytic Geometry and Calculus III	4
PY 208 General Physics	5
MS 201 Military Science II	
or	
AS 221 Air Science II	1
Physical Education	1
	18

Spring Semester	*Credits*
*ENG 205 Reading for Discovery	
or	
ECC 205 The Economic Process	3
EE 202 Elementary Circuits and Fields	4
EM 200 Introduction to Mechanics	3
MA 301 Differential Equations	3
MIM 201 Structures and Properties of Engineering Materials	3
MS 202 Military Science II	
or	
AS 222 Air Science II	1
Physical Education	1
	18

JUNIOR YEAR

Fall Semester	*Credits*
EM 301 Solid Mechanics I	3
MA 401 Intermediate Differential Equations	
or	
MA 511 Advanced Calculus I	3
ME 301 Engineering Thermodynamics I	3
ME 305 Mechanical Engineering Laboratory I	1
ME 352 Aerodynamics	3
SS 301 Science and Civilization	3
Advised Elective	1
	17

Spring Semester	*Credits*
ME 306 Mechanical Engineering Laboratory II	1
ME 353 Introduction to Aerothermodynamics	3
ME 369 Aircraft and Missile Structures	3
PY 407 Modern Physics	3
SS 302 Science and Civilization	3
Elective	3
	16

SENIOR YEAR

Fall Semester	*Credits*
ME 421 Aerospace Propulsion Systems	3
ME 447 Performance, Stability and Control of Flight Vehicles	3
ME 461 Aerospace Technology	3
ME 465 Aerospace Engineering Laboratory I	1
ME 468 Spacecraft Structures	3
SS 491 Contemporary Issues I	3
Elective	3
	19

Spring Semester	*Credits*
ME 432 Boundary Layer Theory and Heat Transfer	3
ME 441 Technical Seminar	1
ME 466 Aerospace Engineering Laboratory II	1
ME 481 Flight Vehicle Design	5
*SS 492 Contemporary Issues II or Elective in Humanities	3
Departmental Elective	3
	16

* See page 132 for information about the Humanities Sequence.

PROFESSIONAL STUDY

A fifth, or professional year of study is offered in mechanical engineering for graduates who desire to return to the University for a program of concentrated study in a selected area. This program is intended primarily for practitioners and is, in no sense, a graduate program leading to the usual advanced degrees. The degree of mechanical engineer is conferred upon graduates of the fifth-year program.

GRADUATE STUDY

The purpose of graduate study in mechanical engineering is to prepare students for a career in research, development, and teaching. Hence, in addition to advanced study, research is an essential part of the graduate program. At present the Department of Mechanical Engineering offers the Master of Science degree in mechanical engineering and aerospace engineering and the Doctor of Philosophy degree in mechanical engineering. Since all graduate programs are administered by the Graduate School, prospective applicants should consult the Graduate School Catalog.

MINERAL INDUSTRIES

Professor W. W. Austin, *Head of the Department*

Professors:
W. C. Bell, W. C. Hackler, W. W. Kriegel, J. M. Parker, III, H. H. Stadelmaier, R. F. Stoops

Adjunct Professor:
H. M. Davis

Associate Professors:
H. S. Brown, J. V. Hamme, C. J. Leith, Hayne Palmour, III

Visiting Research Associate:
J. D. Schobel

Assistant Professors:
G. O. Harrell*, W. C. Hood

Instructors:
L. T. Jordan, L. E. Poteat, J. M. Waller

* Leave of absence 1963-65.

The primary objectives of the Department of Mineral Industries are the training and professional development of qualified technical and administrative leaders for those industries concerned with the location and utilization of mineral resources. Included within this scope of operation are the fields of geological, ceramic, and metallurgical engineering.

CURRICULA

Complete four-year undergraduate curricula in geological, ceramic, and metallurgical engineering are available in the department. Fifth year professional programs also are available for advanced work and specialization in each of these fields, and graduate programs leading to the master's and doctor's degree in ceramic engineering, and to the master's degree in geological engineering and metallurgical engineering are offered.

FACILITIES

The facilities of the Department of Mineral Industries are housed in Page Hall and the Ceramic Building. Located in Page Hall are departmental offices, drawing rooms, classrooms and extensive laboratory facilities for instructional work and research in the three areas of study covered by the department. Typical of the numerous well equipped laboratories in the building are those established for instruction in the following areas of study: ceramic operations and processes, dielectric measurements, ceramic microscopy, physical geology, mineralogy, mineral dressing, petrology, geochemistry, geophysics, physical metallurgy, metallography, and X-ray analysis. Other laboratory facilities, particularly kilns and furnaces, are housed in the Ceramic Building next door. Important additional facilities for instruction and research are located in the engineering research department's Ceramic and Metallurgical Research Laboratories. Here equipment and instrumentation are available for advanced work in high temperature technology, X-ray diffraction, differential thermal analysis, thermogravimetric analysis, radiography, electron microscopy, and photomicrography.

STUDENT ACTIVITIES

The student branches of the American Ceramic Society, American Society for Metals, and the American Institute of Mining, Metallurgical and Petroleum Engineers through their monthly meetings provide an effective medium for the professional growth of the student engineers. Programs include presentation of student papers, guest speakers and social contact between student and staff. Participation acquaints the student with parliamentary and organizational procedures which are of great importance to professional, industrial and civic life. Students are encouraged to attend local section and national meetings of their respective societies. Keramos, the oldest profes-

sional engineering fraternity and Alpha Sigma Mu, honorary metallurgical fraternity, have active chapters in the department. These fraternities are dedicated to the promotion of scholarship, mental achievement and general service to ceramic and metallurgical engineering students.

CERAMIC ENGINEERING

The undergraduate curriculum in ceramic engineering is the result of years of study and development and is designed to meet the challenges of modern civilization. The program of study encompasses a thorough grounding in the basic physical sciences and the fundamental disciplines of engineering. Processes and operations peculiar to ceramic engineering are developed from the viewpoint of interpreting and applying the underlying scientific laws, rather than empirical methods of procedure. The ceramic studies include the characterization of raw materials, comminution and associated phenomena, forming and fabrication processes, reaction kinetics in ceramic systems, introductions to research and control techniques, studies of the vitreous state, microstructure and properties of ceramics, and design of ceramic systems and processes. Attitudes of research, experimentation and originality of thought are fostered.

Because the department is dedicated to training young men for leadership, and because of the recognition that responsible leadership should be vested in thinking, well-oriented men, the curriculum includes a planned program of social and humanistic studies. This program is designed to prepare the student for an understanding and appreciation of his responsibilities to society, his profession, and himself, to the end that he will lead a fuller, more productive and satisfying life.

OPPORTUNITIES

Professional training in ceramic engineering provides opportunities for employment in an industry producing a wide variety of essential products including glass in all its forms, enamels and protective coatings for metals, structural clay products such as brick and tile, refractories for furnace linings, thermal insulators, electrical insulators, dielectric components, Portland cement, gypsum products, abrasives, pottery products, and hundreds of other items. In addition to these "end products" ceramics are finding ever increasing applications in the electronic, aerospace, automotive and atomic energy fields. A continuing shortage of qualified personnel in ceramic engineering has resulted in far more employment offers than there are graduates. Initial employment upon graduation may be in the fields of research and development, in-plant operation and control, and in technical sales and service. Such employment may lead to positions as directors of research, consulting and design engineers, sales directors, plant superintendents, production managers, and finally, administrative officers.

CERAMIC ENGINEERING CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MA 202 Anal. Geometry and Calculus III	4	MA 301 Diff. Equations I	3
PY 208 General Physics	5	EC 205 Economic Processes	3
ENG 205 Reading for Discovery	3	MIG 120 Physical Geology	3
MIM 201 Structures and Properties of Engr. Materials	3	MIC 218 Intro. to Ceram. Engineering	4
Military or Air Science II	1	Military or Air Science II	1
Physical Education	1	Physical Education	1
Advised Elective	1	Advised Elective	3
	18		18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EM 200 Introduction to Mechanics	3	EM 301 Solid Mechanics I	3
CH 431 Physical Chemistry I	3	CH 433 Physical Chemistry II	3
SS 301 Science and Civilization	3	SS 302 Science and Civilization	3
MIG 331 Crystal. and Opt. Micro.	4	MIC 306 Thermal Processing	4
MIC 305 Ceramic Form. and Fab. Processes	4	MIC 431 Reaction Kinetics in Ceramic Systems	4
	17		17

Six Weeks Summer Employment

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EE 331 Principles of Elec. Engineering	4	MIC 433 Ceram. Microstructure and Properties	4
MIC 430 Research and Control Methods	3	MIC 416 Ceramic Engineering Design	3
MIC 432 Principles of the Glassy Phase	4	MIC 491 Seminar	1
MIC 415 Ceramic Engineering Design	3	Humanities or Social Science Elective	3
SS 491 Contemporary Issues	3	Free Electives	6
	17		17

TOTAL REQUIREMENTS .....140 credits

PROFESSIONAL YEAR

A fifth, or professional year of study is offered in ceramic engineering as a continuation of the four-year undergraduate program. This professional year of study offers specialized advanced course work leading to the degree of Ceramic Engineer, and is especially designed for those planning careers in industrial production activities and technical service and sales. Each program of study is designed to suit the needs of the individual student. The curriculum shown below is typical of these programs. Regulations covering professional study are shown on pages 174 and 175.

TYPICAL PROFESSIONAL PROGRAM IN CERAMIC ENGINEERING

Fall Semester	*Credits*
IE 408 Production Control	3
MIC 597 Advanced Ceramic Experiments	3
MIC 533 Advanced Ceramic Engineering Design	3
Electives	6
	15

Spring Semester	*Credits*
IE 332 Motion and Time Study	4
MIC 534 Advanced Ceramic Engineering Design	3
MIC 527 Refractories in Service	3
Electives	6
	15

GEOLOGICAL ENGINEERING

Geological engineering is a technical field in which geological facts are combined with engineering techniques for the solution of problems concerned mainly with mineral raw material supply and with engineering projects. Many major engineering undertakings, such as construction of large dams and reservoirs, tunnels, and large buildings, depend for success in part on an exact knowledge of their geological setting. On the other hand, such geological problems as the economical development of mineral resources require the use of the precise methods of engineering. In the field of geological engineering, then, geology contributes data concerning the constitution, structure and history of the earth; engineering supplies quantitative, analytical methods through which physical and chemical laws may be controlled for mankind's benefit. The geological engineering curriculum combines those fundamental disciplines regarded as basic to all engineering with training in the aspects of geology that are of most practical application to human affairs.

OPPORTUNITIES

A graduate in this curriculum may follow one of two broad fields of engineering, either in the United States or in foreign countries: one, the application of geology to engineering work; the other, the application of geology in the mineral industries. Geological engineers are currently employed by oil companies and quarrying concerns; exploration companies; construction firms; railroads, public utilities, banks and insurance companies; iron, steel and other metal producers; manufacturers using non-metallic raw materials, as for ceramics, cement, and abrasives; municipal, state and federal government agencies; schools, colleges, museums and research institutes. The southeastern United States offers excellent opportunities for geological engineers. There is a growing need for the application of geological science to engineering construction in connection with highways, foundations, excavations, and in water supply problems. The mineral industry of the Southeast has expanded substantially in the last

decade; known deposits in the region, as yet only partially developed, include iron, nickel, copper, chromite, molybdenite, feldspar, mica, kaolin, kyanite, sillimanite, pyrophyllite, talc, barite, spodumene, sulphur (pyrite), coal, phosphate, granite, limestone, and marl.

GEOLOGICAL ENGINEERING CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MA 202 Analytic Geometry and Calculus III	4	MA 301 Differential Equations	3
PY 208 General Physics	5	CH 231 Introduction to Physical Chemistry	4
MIG 120 Physical Geology	3	MIG 222 Historical Geology	3
EC 205 Economic Process	3	ENG 205 Reading for Discovery	3
Physical Education	1	Physical Education	1
MS 201 Military Science II or AS 221 Air Science II	1	MS 202 Military Science II or AS 222 Air Science II	1
	17		15

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EM 200 Introduction to Mechanics	3	EM 301 Solid Mechanics I	3
SS 301 Contemporary Civilization	3	SS 302 Contemporary Civilization	3
MIG 331 Crystallography and Optical Microscopy	4	EE 320 Elements of Electrical Engr.	4
CE 201 Engineering Measurements in Surveying	3	MIG 440 Endogenic Materials and Processes	4
Advised Elective	3	MIG 462 Geological Surveying	3
	16		17

SUMMER SESSION

MIG 465 Geological Field Procedures 6

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EM 303 Fluid Mechanics	3	Advised Electives	5
SS 491 Contemporary Issues	3	MIG 415 Mineral Exploration and Evaluation*	3
MIG 351 Tectonic Structures	3	MIG 552 Exploratory Geophysics*	3
MIG 452 Exogenic Materials and Processes	4	Electives	6
Electives	3		17
	16		

TOTAL (including summer) 140

* Specialization in engineering geology or in geology of mineral deposits may be achieved by approved substitution of the following course: CE 547, Fundamentals of Soil Mechanics; MIG 461, Engineering Geology; MIG 472, Elements of Mining Engineering.

PROFESSIONAL STUDY

A fifth or professional year of study is offered in geological engineering as a continuation of the fourth-year undergraduate program. This fifth year of study offers specialized and advanced work leading to the degree of geological engineer. The program requirements are arranged individually for each student. Regulations covering professional study are shown on pages 174 and 175.

TYPICAL PROFESSIONAL PROGRAM IN GEOLOGICAL ENGINEERING

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MIG 461 Engineering Geology	3	MIG 522 Petroleum Geology	3
MIG 571 Mining and Mineral Dressing	3	MIG 552 Exploratory Geophysics	3
MIG 581 Geomorphology	3	MIG 572 Mining and Mineral Dressing	3
MIG 611 Advanced Economic Geology	3	MIG 612 Advanced Economic Geology	3
Elective	3	Elective	3
	15		15

METALLURGICAL ENGINEERING

The undergraduate curriculum in metallurgical engineering is a standard four-year program designed to produce technically trained leaders for those industries and agencies associated with the development, production, and fabrication of metals and alloys. The major emphasis is on the application of the principles of physical and mechanical metallurgy to engineering problems encountered in these industries. Major sequence courses for the development of this emphasis are offered during the third and fourth years of the curriculum and are preceded by a well rounded program of basic and engineering sciences, and humanities. Because of this arrangement it is possible for a student to complete the first two years of his training at a suitably qualified liberal arts college and to transfer to North Carolina State for the final two years. While such an arrangement is encouraged it is nevertheless advisable for the prospective transfer student to seek the guidance and counsel of the School of Engineering administration at the beginning of his college career in order to minimize difficulties associated with the transfer of credits. The metallurgical engineering curriculum is unique in the School of Engineering in that it provides a minor sequence of 12 credits in a related field of engineering or science to be elected by the student with his advisor.

OPPORTUNITIES

Opportunities open to graduates in metallurgical engineering are virtually unlimited. Each year the demand for men with metallurgical training becomes more urgent, and the number of positions presently available is several times greater than the number of graduates. A graduate metallurgical engineer may thus choose from a wide selection

of companies, locations, and types of work. Among the more important job opportunities open to metallurgical engineers are those in research and development of new alloys so desperately needed as materials of construction in the rapidly expanding fields of chemical, mechanical, aero-space, electronic, and nuclear technology. With the rapid industrialization of the South and particularly the State of North Carolina, new opportunities are constantly developing for metallurgical engineers who will play a vital role in maintaining the forward progress of the State and region.

METALLURGICAL ENGINEERING CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ENG 205 Reading for Discovery	3	EC 205 The Economic Process	3
MA 202 Calculus II	4	MA 301 Differential Equations	3
PY 208 General Physics	5	EM 200 Introduction to Mechanics	3
IE 217 Machine Tools	1	IE 218 Metal Forming	1
MIM 201 Structure and Properties of Engineering Materials*	3	EE 201 Electrical Engineering	4
MS 201 Military Science II or AS 211 Air Science II	1	MS 202 Military Science II or AS 212 Air Science II	1
Physical Education	1	Physical Education	1
	18		16

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
EM 301 Solid Mechanics I	3	EM 303 Fluid Mechanics	3
CH 431 Physical Chemistry	3	CH 433 Physical Chemistry	3
MIM 331 Physical Metallurgy I	3	MIM 332 Physical Metallurgy II	3
SS 301 Contemporary Civilization	3	SS 302 Contemporary Civilization	3
Minor Sequence	3	Minor Sequence	3
Electives	3	Electives	3
	18		18

Six weeks summer employment

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MIM 401 Metallurgical Operations	4	MIM 402 Metallurgical Operations	4
MIM 431 Metallography	3	MIM 432 Metallography	3
MIM 451 Seminar	1	MIM 452 Seminar	1
SS 491 Contemporary Issues	3	Advised Elective	3
Minor Sequence	3	Minor Sequence	3
Electives	3		
	17		14

TOTAL CREDITS 140

* Transfer students who have satisfactorily completed the equivalent of all first and second year courses except MIM 201, and who can present acceptable electives in lieu of this course, will be admitted as third year students in metallurgical engineering. They will be permitted to take this course in addition to the regular third year program, substituting it for three credits of electives permitted in the third year.

PROFESSIONAL STUDY

A fifth, or professional year of study is offered in metallurgical engineering as a continuation of the four-year undergraduate program. This professional year of study offers specialized advanced course work leading to the professional degree of metallurgical engineer. It is especially designed for students planning careers in industrial production activities, or in technical service and sales. Each program of study is designed to suit the needs of the individual student. The curriculum shown below is typical of these programs.

Regulations covering professional study are shown on pages 174-175.

TYPICAL PROFESSIONAL PROGRAM IN METALLURGICAL ENGINEERING

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MIM 521 Advanced Physical Metallurgy	3	MIM 522 Advanced Physical Metallurgy	3
MIM 523 Metallurgical Factors in Design	3	MIM 524 Metallurgical Factors in Design	3
MIM 445 Experimental Engineering	3	MIM 446 Experimental Engineering	3
PY 407 Modern Physics	3	CHE 502 Electrochemical Engineering	3
ME 502 Heat Transfer	3	ME 515 Experimental Stress Analysis	3
	15		15

NUCLEAR ENGINEERING

Burlington Professor RAYMOND L. MURRAY, *Head of the Department*

Professor:
R. F. SAXE

Adjunct Professor:
R. L. ELY

Associate Professor:
T. S. ELLEMAN

Assistant Professors:
KURUVILLA VERGHESE; M. A. WELT, *Director of the Nuclear Reactor Project*

Instructors:
ALBERT CARNESALE, B. E. LEONARD

Reactor Engineers:
J. C. BATCHELOR, W. B. BOWMAN, J. F. TORRENCE

Affiliated Graduate Faculty:

Professors:
W. O. DOGGETT, J. K. FERRELL, A. W. WALTNER

Associate Professors:
A. F. COOTS, M. R. EL-SADEN, E. G. MANNING, M. N. OZISIK

Assistant Professors:
L. H. BOWEN, R. W. LADE

The field of nuclear engineering is concerned with the engineering aspects of the control, release, and utilization of nuclear energy. Nu-

clear reactors serve many functions—they serve as heat sources for economical electric power plants, are the basis of modern propulsion systems for ships and submarines, and produce fissionable and radioactive isotopes for a variety of peaceful applications. Nuclear devices supply auxiliary power and propulsion energy for space vehicles in operation and being developed. The purpose of the nuclear engineering department is to educate the individual in those scientific and engineering principles essential for effective and productive contributions in industrial, university, and government service.

CURRICULUM

Nuclear engineers have the opportunity to work in the areas of nuclear system research, design, development, testing, operation, and marketing. The Bachelor of Science degree program is designed to prepare graduates for positions in industry or government laboratories or for graduate study in the field. The curriculum incorporates basic sciences and engineering, with special emphasis on mathematics and physics, followed by coursework in nuclear science and technology. Attention is given to the engineering design of nuclear reactors and associated systems. Among the courses taken in the junior and senior years is a sequence in an elected area of technical emphasis such as nuclear energy conversion, nuclear instrumentation, nuclear materials, radiological safety, or radiochemistry.

GRADUATE STUDY

The Department of Nuclear Engineering provides a full program of courses leading to the Master of Science and Doctor of Philosophy degrees. Thesis direction is provided by the staff of the department and affiliated graduate faculty members. Areas of research specialization include radiation effects and utilization, nuclear reactor theory and design methods, and reactor statics and kinetic measurements. For additional information consult the Graduate School Catalog.

FACILITIES

Facilities available on campus for nuclear training at the undergraduate level as well as the graduate level include:

A 500 kw heterogeneous reactor
Analog and digital computers
A sub-critical assembly
Single- and multi-channel pulse height analyzers
A slow chopper
Radiation counting laboratories
Neutron diffraction apparatus

OPPORTUNITIES

Although the nuclear industry is relatively young, it already represents a major national effort. Reactor development and construction

have proceeded at a remarkable pace and will continue to grow as we become increasingly dependent upon nuclear energy as a substitute for energy from fossil fuels. Industrial applications of radiation will accelerate as the economic potential of such methods becomes even more firmly established. There is at present a substantial need for nuclear engineers, and prospects for the future are promising.

NUCLEAR ENGINEERING CURRICULUM

For the freshman year see page 133.

SOPHOMORE YEAR

Fall Semester	*Credits*
MA 202 Analytic Geometry and Calculus III	4
PY 206 General Physics	4
MIM 201 Structures and Properties of Engineering Materials	3
ENG 205 Reading for Discovery	3
Advised Elective	1
MS 201 Military Science II or AS 221 Air Science II	1
Physical Education	1
	17

Spring Semester	*Credits*
MA 301 Differential Equations	3
PY 207 General Physics	4
EM 200 Introduction to Mechanics	3
ST 361 Introduction to Statistics for Engineers	3
EC 205 The Economic Process	3
MS 202 Military Science II or AS 222 Air Science II	1
Physical Education	1
	18

JUNIOR YEAR

Fall Semester	*Credits*
MA 401 Intermediate Differential Equations or MA 511 Advanced Calculus I	3
EM 301 Solid Mechanics I	3
CHE 421 Reactor Energy Transfer I	3
EE 331 Principles of Electrical Engineering I	4
SS 301 Science and Civilization	3
Free Elective	3
	19

Spring Semester	*Credits*
PY 410 Nuclear Physics I	4
CHE 422 Reactor Energy Transfer II	3
EE 332 Principles of Electrical Engineering II	4
SS 302 Science and Civilization	3
Technical Emphasis	4
	18

SENIOR YEAR

Fall Semester	*Credits*
NE 501 Nuclear Reactor Theory I	3
SS 491 Contemporary Issues	3
Technical Emphasis	3
Advised Elective	3
Free Elective	3
	15

Spring Semester	*Credits*
NE 502 Nuclear Reactor Theory II	3
NE 503 Nuclear Engineering Systems	3
NE 531 Nuclear Reactor Laboratory	2
Technical Emphasis	3
Senior Humanities Elective*	3
Advised Elective	3
	17

* See page 132 for information about the Senior Humanities Elective.

PROFESSIONAL PROGRAM IN ENGINEERING

The School of Engineering offers fifth-year professional curricula leading to the degrees Ceramic Engineer, Civil Engineer, Chemical Engineer, Electrical Engineer, Geological Engineer, Industrial Engineer, Mechanical Engineer, and Metallurgical Engineer. These curricula are tailor-made to fit the particular needs of each student with a view that upon completion of a program the student will be prepared to pursue a professional career in engineering.

It is the intent of the fifth-year program to emphasize professional course work rather than research. To this end, a curriculum is comprised of 30 semester credits of course work requiring of the student a minimum of one academic year in residence. Neither a thesis nor a reading knowledge of a foreign language is required. Samples of curricula that meet the requirements of the fifth-year program may be found under the appropriate departmental curricula. These curricula are to be considered illustrative; the actual program of study will be especially designed to fit the needs of the individual student.

ADMISSION

Applicants who hold the bachelor's degree in engineering from recognized colleges will be admitted to the professional program of the School of Engineering upon presentation of official credentials. For unconditional admission, these credentials must show the completion, with a minimum grade point average of 2.5 (C+), of an amount of undergraduate work in the proposed field of professional study corresponding to that normally required for a bachelor's degree in that field.

Admission on a provisional basis may be granted applicants who do not meet the formal requirements. In case of insufficient preparation, prerequisite courses will be prescribed in addition to the normal fifth-year course requirements.

A letter of application, accompanied by full credentials in the form of transcripts of academic records, should be filed in the office of the dean of the School of Engineering at least 30 days in advance of the semester in which admission is sought.

GENERAL REGULATIONS

The following regulations of the School of Engineering will be observed:

1. An undergraduate enrolled at North Carolina State, who plans to undertake a professional program and who has fulfilled all requirements for the bachelor's degree except one or two courses, may be permitted to enroll in certain courses and later obtain credit toward the professional degree provided the student gives notice of his purpose to the dean of the School of Engineering. The maximum credit to be obtained in this way is six semester course credits.

2. Credit for professional work to be applied toward the requirements for the professional degree, not to exceed six semester credits, may be transferred to North Carolina State from recognized institutions of university grade offering advanced work in engineering and related fields. Such a transfer of credit must be recommended by the head of the department in which the student does his major work and it must be approved by the dean of the School of Engineering.

3. Fifth-year students are classified as post-baccalaureate students and are subject to rules and regulations as established and administered by the dean of the School of Engineering.

4. Grades for each completed course are reported to the dean of the School of Engineering and to the Office of Registration. A minimum grade of "C" must be made in each course to obtain credit. A quality point average of 2.5 (C+) in all course work must be attained to satisfy requirements for a professional degree.

5. Work completed more than six years prior to the date on which the professional degree is to be granted may not be used as credit toward the professional degree, unless approved by the head of the department concerned and the dean of the School of Engineering.

6. Each fifth-year student will be assigned to a committee consisting of his department head and the professor in charge of the work in which he is majoring. The function of this committee is to assist the student in preparing a program of study and to counsel him in his academic work. The student will be required, with the assistance of his committee, to prepare a complete plan of study before mid-semester of his first semester in residence. This program of study is subject to the approval of the dean of the School of Engineering.

School of Forestry

Richard J. Preston, *Dean*

While forestry has been recognized and practiced for centuries in Europe, this profession is relatively new in the United States, dating from about the beginning of the 20th Century. During the period of rapid expansion and development of the United States, the forests were badly neglected and abused. Now, however, with the timber supplies depleted and the value of timber products increasing, sound forest practices have been accepted as economically desirable and feasible. Increasing the productivity and quality of our forests is basic to the welfare of the Southeast. The importance of the forest resource in the economy of North Carolina is brought out by the fact that 62 percent of the land area is in forest, with wood products

industries ranking next to textiles as a source of industrial employment.

Through a program which offers a broad training in the physical and biological sciences, as well as a sound cultural background, the School of Forestry prepares students for service in the professional fields of forest management, pulp and paper technology, and wood technology.

CURRICULA

The School, through its departments of forest management and wood science and technology, offers undergraduate instruction leading to the degree of Bachelor of Science in the professional fields of forest management, wood technology, and pulp and paper technology. All curricula have a common freshman year thus enabling the student to postpone selection of a major field until he has had an opportunity to become acquainted with its scope and possibilities.

Forest management deals with all phases of the management of wild lands and includes such related subjects as water-shed protection, wildlife management and recreation. In order that the student may be adequately prepared for work of such diverse nature, the curriculum provides training in such subjects as silviculture, timber estimating, management, fire prevention and control, forest pathology, insect control, forest soils, economics, and other aspects of land use.

The course of study in wood technology, which is concerned with the technical aspects of utilization, includes training in all types of wood using and wood manufacturing industries. It incorporates technical and practical principles of logging, milling, seasoning, gluing, preserving, finishing, fabricating, and machining, and includes the fundamentals of sound business administration.

Pulp and paper technology trains men for work in pulp and paper mills. Students are given thorough training in chemistry, mathematics, physics, wood structure and properties, pulping processes and engineering subjects related to pulp and paper manufacturing.

DEGREES

The Bachelor of Science degree is conferred upon the satisfactory completion of any of the four-year curricula in the areas mentioned above.

Professional preparation beyond the four-year curricula is desirable, and qualified students are urged to plan a five-year program leading to the master's degree. The degree of Master of Science is offered for those desiring specialization in the fields of scientific research. For students desiring a thorough professional background, the School offers the degree of Master of Forestry or Master of Wood Technology.

The degree of Doctor of Philosophy is offered in several fields of forestry and wood technology.

Further information regarding graduate study is contained in the Graduate School Catalog which may be obtained from the dean of the Graduate School.

FACILITIES AND LABORATORIES

The School of Forestry is now housed in three modernly equipped buildings on the west side of the campus. Faculty offices, classrooms, and laboratories are located in Kilgore Hall, the main forestry building. In addition, two buildings house specialized programs which are unique in the South.

Wood Products Laboratory

The Brandon P. Hodges Wood Products Laboratory is one of the largest and best equipped laboratories in existence for the conduct of research and training in wood technology. Staff offices, research facilities, wood structure, chemistry and physical properties laboratories are located in the forestry building. In addition, the Brandon P. Hodges Laboratory building houses the wood machining, finishing, gluing and preserving laboratories, as well as the sawmill, dry kilns, and veneer plant. The laboratory provides service to the wood using industries in the development of methods of quality control, production control, operations analysis, and market analysis. Graduate students in wood technology participate in the laboratory's research program as a part of their advanced training.

Reuben B. Robertson Laboratory of Pulp and Paper Technology

The curriculum in pulp and paper technology is approved as the regional program to serve the Southeast. The Robertson Laboratory provides unique and outstanding facilities for instruction and research. Located in the building are wood preparation, chemical, pulping, pulp and paper testing, and coloring laboratories, as well as digesters, and a small paper machine.

School Forests

The School of Forestry, with more than 80,000 acres of forest land and three permanent field camps, has facilities unexcelled in many respects for field instruction and research.

The Hofmann Forest, owned and operated by the North Carolina Forestry Foundation for the benefit of the School of Forestry, consists of approximately 78,000 acres located in Jones and Onslow counties in the southeastern portion of the State. Pine and loblolly pine together with hardwood and cypress swamps characterize this tract.

The George Watts Hill Demonstration Forest is a tract of 1,500 acres located 16 miles north of Durham. This typically Piedmont forest of rolling terrain contains stands of loblolly, shortleaf, and Virginia pines along with numerous hardwoods. The permanent summer camp for sophomores is located in this area. This Piedmont area is supplemented by the 1,750 acre Hope Valley Forest near Chapel Hill.

The Wayah Recreational Area on the North Carolina National Forest near Franklin is located in a typical mountain forest. Facilities at this area have been leased from the government and portions of the sophomore summer camp are held in permanent quarters of this mountain tract.

The Carl Alwin Schenck Memorial Forest of 250 acres located four miles northwest of the campus is being developed into a model farm forest and is used for field instruction near the campus.

The School nursery is equipped for instructional purposes and the production of planting stock.

FIELD INSTRUCTION AND EXPERIENCE

All students are required to present a minimum of one summer of acceptable work experience in order to meet the graduation requirements. Students are required to consult with their advisors as to what type of employment will be acceptable.

The sophomore summer camp is a requirement for students in forest management. This camp is prerequisite for junior standing. Permanent, well equipped camps are maintained on these coastal, Piedmont, and mountain forests. A "C" average is required for admission to these camps.

Wood technology students are required to attend a 10-week practicum following the sophomore year. This practicum is prerequisite for junior standing. The first half of this period is devoted to laboratory exercises in machining, gluing, drying and finishing wood; preparation of particle board; operation safety and maintenance of equipment; and plant inspections. The second half covers experience in logging, milling, cruising, and graphic methods.

Additional field instruction and scheduled trips to representative wood industries are required of all students as a part of their class assignments. To cover the costs of chemical supplies and off-campus training all students enrolled in the School of Forestry pay a field laboratory fee of $10 each year at the time they first register during a school year. A maintenance and supply fee of $20 is charged for both the summer camp and practicum.

OPPORTUNITIES

A wide and rapidly expanding field of employment possibilities is available in the Southeast to young men trained in forestry. Until recent years most job opportunities were with government agencies in managing public forests, and this still constitutes a major source of employment. These agencies include state and federal forest services, extension services, and other groups such as the Soil Conservation Service and the Tennessee Valley Authority.

In recent years job opportunities with private industries have expanded greatly. Increasing numbers of technically trained young men are entering a wide variety of professional positions in the fields of forest land management, water-shed management, logging, sawmilling,

veneer and plywood manufacturing, pulp and paper making, kiln drying, wood preservation and the manufacture of wood products such as furniture, dimension stock and various prefabricated items.

The merchandising of lumber and lumber products offers numerous opportunities for students qualified for sales, business administration or small building construction. Sawmills and lumber yards, plywood and paper manufacturers, and flooring, wallboard, and other forest products plants need trained men.

Exceptional students will find opportunities for employment in research or teaching. This type of work ordinarily requires a graduate degree. There has been an increasing demand for well-trained woodlands managers and wood technologists, as well as for research workers in government experiment stations and laboratories.

More than 80 percent of the graduates of the School of Forestry are now employed in some field of forest or wood products work. The few students who have not followed the forestry profession have found their college education sufficiently broad to provide a sound basis for a wide variety of work.

EXTENSION PROGRAMS

The Forestry Extension Program of the Agricultural Extension Service is a vital part of the School's forestry activities. This program serves the landowners and wood industries of the State. It is responsible for their understanding, acceptance, and application of new ideas and techniques developed through research and experience. The two major fields of program emphasis are forest management, where extension specialists train and work through the county agents; and wood products, where the specialists work more or less directly with wood industry owners and managers.

In cooperation with the General Extension Division, short courses are offered in a number of fields to provide men in industry an opportunity to keep abreast of modern developments in techniques and equipment.

FELLOWSHIPS, SCHOLARSHIPS, AND LOAN FUNDS

A number of undergraduate scholarships, research assistantships and training fellowships are available to qualified students. Students interested in applying should write to the dean of the School of Forestry.

The Hofmann Loan Fund was established by alumni of the School of Forestry to honor Dr. J. V. Hofmann, the first director of the Division. Loans to worthy students who can demonstrate financial need are available through several loan funds.

Many students help pay their expenses through part-time work at the University or in town. The Financial Aid Office assists in locating employment.

HONORS PROGRAM

Students making exceptional academic records during their freshman and sophomore years may, with the approval of the faculty, elect to follow an honors program. These students are required to enroll in the core courses in the several curricula but are otherwise free to utilize their electives to develop individual courses of study designed to meet their needs and satisfy their interests, subject only to the approval of the honors advisor.

FRESHMAN YEAR IN ALL FORESTRY CURRICULA

Fall Semester	*Credits*
BS 100 General Biology	4
**CH 101 General Inorganic Chemistry	
or	
**CH 105 General Inorganic Chemistry	4
ENG 111 Composition	3
FOR 101 Introduction to Forestry	1
***MA 111 Algebra, Trigonometry	4
MS 101 Military Science I	
or	
AS 121 Air Science I	1
Physical Education	1
	18

Spring Semester	*Credits*
*BO 214 Dendrology	4
or	
*EC 201 General Economics	3
and	
*ME 101 Engineering Graphics	2
**CH 103 General and Qualitative Chemistry	
or	
**CH 107 General and Qualitative Chemistry	4
ENG 112 Composition	3
**MA 112 Analytic Geometry and Calculus A	4
MS 102 Military Science I	
or	
AS 122 Air Science I	1
Physical Education	1
	17 or 18

* Forest Management and Wood Technology students take BO 214; Pulp and Paper students take ME 101 and EC 201.

** Forest Management and Wood Technology students take CH 101 and 103; Pulp and Paper students take CH 105 and 107.

*** Students with adequate backgrounds should take MA 101, 102.

FOREST MANAGEMENT

Professor T. E. MAKI, *Head of the Department*

Professors:
R. C. BRYANT, J. W. DUFFIELD, ARTHUR KELMAN, J. O. LAMMI, R. J. PRESTON, B. J. ZOBEL

Associate Professors:
A. W. COOPER, C. B. DAVEY, M. H. FARRIER, J. W. HARDIN, T. O. PERRY

Assistant Professors:
P. J. DYSON, C. S. HODGES, S. J. MADDOCK, GENE NAMKOONG, L. C. SAYLOR

Instructors:
R. C. KELLISON, R. L. MCELWEE

Forest management is the application of business methods and technical forestry principles to the operation of forest properties. This field requires a knowledge of individual trees and timber stands, of different forest types and entire forest areas, as well as of the basic biological relationships within the forests. It also requires a

knowledge of land surveying, timber cruising, measurement of forest products, and of the economic factors involved in the business of growing wood crops.

CURRICULUM

The curriculum in the field of forest management is structured to provide a foundation of basic subjects in science, mathematics, and humanities, a core of general forestry subjects, and enough electives to permit limited specialization. Twenty-four elective credits are included to provide the opportunity for the desired specialization. At the beginning of his junior year, the student chooses one of several areas of specialization and selects appropriate courses under that field for his elective credits.

The curriculum leads to the degree of Bachelor of Science in the broad field of forest management. A minimum of 152 credits is required for graduation.

OPPORTUNITIES

Students who complete the curriculum are trained for positions with pulp companies, lumber companies, and other private landowners; federal and state forest services; agricultural extension; and for private enterprise as consultants, forest landowners or sawmill operators.

FOREST MANAGEMENT CURRICULUM

For the freshman year see page 180.

SOPHOMORE YEAR

Fall Semester	*Credits*
EC 201 General Economics	3
ENG 205 Reading for Discovery	3
FOR 202 Wood Structure and Properties	3
MA 211 Analytic Geometry and Calculus	3
PY 211 General Physics	4
MS 201 Military Science II or AS 221 Air Science II	1
Physical Education	1
	18

Spring Semester	*Credits*
CH 220 Organic Chemistry	4
FOR 219 Forest Economy and Its Operation	3
PY 212 General Physics	4
SSC 200 Soils	4
MS 202 Military Science II or AS 222 Air Science II	1
Physical Education	1
	17

SUMMER CAMP

	Credits
FOR s204 Silviculture	3
FOR s264 Protection	3
FOR s274 Mapping and Mensuration	3
FOR s284 Utilization	1
	10

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
FOR 361 Silvics	3	FOR 362 Silvics	3
ST 311 Statistics	3	FOR 372 Mensuration	3
*ENT 301 Forest Insects	3	*PP 318 Forest Tree Diseases	3
**English Elective	3	**English Elective	3
***Option Requirement and Electives	9	***Option Requirement and Electives	9
	18		18

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
FOR 531 Forest Management	3	FOR 511 Silviculture	3
***Option Requirement and Electives	15	FOR 532 Forest Management	3
		***Option Requirement and Elective	12
	18		18

FOREST MANAGEMENT FIELDS OF SPECIALIZATION

The fields of specialization in forest management include (a) general forestry, (b) forest management science, (c) forest mensuration, (d) watershed management, (e) forest biology, (f) forest recreation and parks, and (g) forest wildlife management.

A student selects one of the above fields and schedules the approved courses in that specialization.

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* Either ENT 301 or PP 318 is required of all students. English elective is scheduled for alternate semester.

** Students not making better than "C" average in ENG 111, 112, or presenting transfer credits for ENG 111, 112 will schedule ENG 321, Scientific Writing.

*** Electives must include at least 9 credits in humanities or social sciences.

WOOD SCIENCE AND TECHNOLOGY

Professor E. L. Ellwood, *Head of the Department*

Professors:
R. M. Carter, B. A. Jayne, A. J. Stamm

Associate Professors:
A. C. Barefoot, C. A. Hart, R. G. Hitchings

Assistant Professors:
H. D. Cook, P. J. Dyson, C. G. Landes, J. T. Rice, R. J. Thomas

Instructor:
R. C. Gilmore

The wood industries have been a vital part of the economy of North Carolina for over 300 years. North Carolina ranks first in the nation in the manufacture of hardwood, plywood and wooden furniture, first

in the South in lumber production and among the leaders in the manufacture of pulp and paper. The value of forest products produced annually in the State exceeds $1,125,000,000. Seventeen percent of the State's labor force is employed in the wood industries.

The Department of Wood Science and Technology offers two curricula, wood technology and pulp and paper technology, to train men for careers in the wood industries.

WOOD TECHNOLOGY

Professor E. L. ELLWOOD, *In Charge*

CURRICULUM

The great wood industries which convert wood into thousands of commercial products offer many opportunities for wood technology majors.

The curriculum has been designed to give sound coverage in mathematics and the sciences and to permit sufficient flexibility to enable students to specialize along lines of major interest. At the end of the sophomore year, wood technology students attend a 10-week practicum which is prerequisite to junior standing. At the beginning of the junior year students select a field of concentration.

The technical elective concentration in Wood Manufacturing and Management together with prescribed course work trains men for supervisory, production, merchandising and eventual management positions in the manufacture, processing and distribution of such products as lumber, veneer, plywood particle board, dimension stock, furniture, cabinets, millwork and flooring.

Provision is also made to enable students to undertake natural science oriented electives leading to research and development opportunities in the wood manufacturing industries and their suppliers.

This curriculum leads to the degree of Bachelor of Science in wood technology. A minimum of 151 credits is required for graduation.

OPPORTUNITIES

A career with wood industries offers a variety of opportunities for young men trained in wood properties, manufacturing operations and business methods. The application of new processes and materials in the conversion of timber into the thousands of wood products has created a demand for technically trained men. Companies manufacturing lumber, veneer and plywood, hardwood dimension stock, furniture, millwork, flooring, pianos, caskets, wood turnings, adhesives, preservatives, finishing materials, and composition boards are types of industries interested in employing graduates.

WOOD TECHNOLOGY CURRICULUM

SOPHOMORE YEAR

Fall Semester	*Credits*
EC 201 General Economics	3
ENG 231 Basic Speaking Skills	3
FOR 202 Wood Structure and Properties	3
*MA 211 Calculus	3
*PY 211 General Physics	4
MS 201 Military Science II or AS 221 Air Science II	1
Physical Education	1
	18

Spring Semester	*Credits*
CH 220 Organic Chemistry	4
FOR 203 Wood Structure and Properties II	3
*MA 212 Calculus	3
ME 101 Engineering Graphics	2
*PY 212 General Physics	4
MS 202 Military Science II or AS 222 Air Science II	1
Physical Education	1
	18

SUMMER PRACTICUM

First Session Wood Products	*Credits*
Practicum (Five Weeks)	
FOR 205-S Wood Machining Practicum	1
FOR 206-S Wood Drying Practicum	1
FOR 207-S Gluing Practicum	1
FOR 208-S Wood Finishing Practicum	1
FOR 209-S Plant Inspections	1
	5

Second Session Wood	*Credits*
Practicum (Five Weeks)	
FOR 210-S Mensuration Practicum	2
FOR 211-S Logging and Milling Practicum	2
FOR 212-S Graphic Methods	1
	5

JUNIOR YEAR

Fall Semester	*Credits*
EM 211 Introduction to Applied Mechanics	3
ENG 321 Scientific Writing	3
FOR 301 Wood Processes I	4
ST 361 Statistics for Engineers	3
Technical Electives	3
	16

Spring Semester	*Credits*
FOR 219 Forest Economy and Its Operation	3
FOR 302 Wood Processes II	4
FOR 444 Intro. to Quality Control	3
Technical Electives	3
Electives	5
	18

* Students who have completed MA 101, 102, should take MA 201, 202, and PY 201, 202.

SENIOR YEAR

Fall Semester	*Credits*
FOR 434 Wood Operations I	3
FOR 521 Wood Chemistry	3
Technical Electives	3
Electives	9
	18

Spring Semester	*Credits*
FOR 435 Wood Operations II	3
FOR 441 Design of Wood Structures	3
Technical Electives	3
Electives	6
	18

FIELDS OF SPECIALIZATION

At the beginning of the junior year, students with outstanding records may, with the approval of the faculty, elect the Honors Program which will stress course work in the natural sciences and mathematics in relation to wood. Other students will select their technical electives from areas of emphasis chosen to stress Wood Manufacturing and Management.

Students concentrating in Wood Manufacturing and Management will select at least two courses from one of the areas of emphasis listed below. The remaining technical elective courses will be selected from the listed areas of emphasis by the student in consultation with his advisor to best fit his particular interests.

TECHNICAL ELECTIVES IN WOOD MANUFACTURING AND MANAGEMENT

	Credits
Economics	
EC 301 Production and Prices	3
EC 302 National Income and Economic Welfare	3
EC 310 Economics of the Firm	3
AGC 521 Procurement, Processing and Distribution of Agricultural Products	3
AGC 551 Agricultural Production Economics	3
Operations Analysis	
EC 450 Economic Decision Processes	3
EC 555 Linear Programming	3
Business Administration	
EC 312 Accounting for Engineers	3
EC 425 Industrial Management	3
Industrial Engineering	
IE 332 Motion and Time Study	4
IE 420 Manufacturing Controls	3

PULP AND PAPER TECHNOLOGY

Professor R. G. HITCHINGS, *In Charge*

CURRICULUM

The curriculum in pulp and paper technology trains men for technical work in the rapidly growing pulp and paper industry. Graduates are prepared for careers as pulp technologists, paper mill chemists, quality control specialists, and mill superintendents. After a thorough background in basic sciences, the program offers special work in wood pulping processes, chemical and by-products recovery, pulp bleaching, and the various papermaking operations such as refining, sizing, filling, coloring, coating and converting.

The pulp and paper industry ranks fifth among all American industries. In 1960 pulp and paper products were valued at 10.7 billions of dollars and the industry employed more than 562,000 skilled workers. This is primarily a Southern industry with 60 percent of the nation's pulpwood produced in the South.

Financially supported by 55 major companies, this program was created to meet the critical need for trained men. It is a regional program and has been approved by the Southern Regional Education Board as the undergraduate program to serve the Southeast in this field. A number of scholarships are available. The new Robertson Laboratory of Pulp and Paper Technology provides this program with outstanding facilities.

All students majoring in this curriculum are required to spend at least one summer working in a pulp or paper mill where arrangements have been made by the University for such employment. Three hours of academic credit are granted the student after completion of 12 weeks of mill work and presentation of a satisfactory report covering

this work experience. In addition to this minimum summer work requirement, students are urged to work in mills the two remaining summers between academic years because of the great value of practical experience in this industry.

This curriculum leads to the degree of Bachelor of Science in pulp and paper technology. A minimum of 147 credits is required for graduation. A fifth year leading to the degree of Bachelor of Science in chemical engineering is available for interested students.

PULP AND PAPER TECHNOLOGY CURRICULUM

For the freshman year see page 180.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CH 221 Organic Chemistry	4	CH 223 Organic Chemistry	4
*MA 211 Calculus B	3	FOR 342 Fiber Analysis	3
*PY 211 General Physics	4	*MA 212 Calculus C	3
MS 201 Military Science II or AS 221 Air Science II	1	*PY 212 General Physics	4
Physical Education	1	MS 202 Military Science II or AS 222 Air Science II	1
English Elective	3	Physical Education	1
Electives	3		
	19		16

* Students who have completed MA 101, 102 should take MA 201, 202, and PY 201, 202.

SUMMER

	Credits
FOR 491 Forestry Problems, Mill Experience	3

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
CHE 301 Elements of Chemical Engineering	3	CHE 302 Elements of Chemical Engineering	3
CH 215 Quantitative Analysis	4	CH 231 Physical Chemistry	4
FOR 321 Pulp and Paper Technology	3	FOR 322 Pulp and Paper Technology	3
ME 304 Fundamentals of Heat Power	3	PSY 200 General Psychology	3
Social Science Elective	3	Social Science Elective	3
English Elective	3	Elective	3
	19		19

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
FOR 411 Pulp and Paper Unit Processes	3	FOR 403 Paper Process Analysis	3
FOR 413 Paper Properties and Additives	4	FOR 412 Pulp and Paper Unit Processes	3
FOR 471 Pulping Process Analysis	4	FOR 461 Paper Converting	1
FOR 491 Senior Research Problem	1	FOR 463 Plant Inspections	1
FOR 521 Wood Chemistry	3	FOR 482 Pulp and Paper Mill Management	2
Electives	3	FOR 522 Wood Chemistry	3
	18	Electives	4
			17

SCHOOL OF LIBERAL ARTS

FRED V. CAHILL, *Dean*

The School of Liberal Arts exists to serve the people of the State of North Carolina in two principal ways. First, the School, in cooperation with other schools and departments on the campus, offers programs leading to the degrees of Bachelor of Arts and Bachelor of Science. Second, the School offers work in the humanities and social sciences which forms a part of the program of all students.

The advantages of a broad college education are too numerous and too familiar to require repetition. We need only to indicate that the circumstances of living in our rapidly evolving society place a heavy premium on the ability to communicate, the capacity for adjustment, and the compassion and tolerance which, in the future as in the past, must always characterize the educated man.

The programs in the School attempt to provide both breadth and depth. They are designed to acquaint the student with the complexities and opportunities in our modern society and to prepare him to assume the position and undertake the responsibilities of an enlightened citizen in the contemporary world.

Nine departments are included in the School of Liberal Arts. They are Economics, English, History and Political Science, Modern Languages, Philosophy and Religion, Physical Education, Psychology (also a department in the School of Education), Social Studies, and Sociology and Anthropology. With the cooperation of the School of Engineering, a program of undergraduate studies in geology is offered.

The School of Liberal Arts offers two degree programs, a Bachelor of Arts and a Bachelor of Science. The coursework for these degrees provides the basis for graduate work, if desired, and leads to a wide variety of professions and occupations. In all major programs an average of at least "C" in the major field is required. It will be greatly to the advantage of the student to present two units of a modern foreign language upon entrance.

CURRICULA

Bachelor of Arts

The program of studies leading to the degree of Bachelor of Arts, with majors in economics, English, geology, history, philosophy, political science, psychology, and sociology, is as follows:

FRESHMAN YEAR

Fall Semester	*Credits*
ENG 111 Composition and Rhetoric	3
*Modern Language	3
HI 245 European Civilization	3
**Social Science	3
***Mathematics	4
Physical Education	1
MS 101 Military Science I	
or	
AS 121 Air Science I	1
	18

Spring Semester	*Credits*
ENG 112 Composition and Reading	3
Modern Language	3
HI 246 European Civilization	3
Social Science	3
Mathematics	4
Physical Education	1
MS 102 Military Science I	
or	
AS 122 Air Science I	1
	18

* At the intermediate level.

** Economics 201, 202; Political Science 201, 202, 301, 322; Psychology 200, 210; Sociology 202, 301; Anthropology 252, 305. Two of the required four courses must be in departmental sequence.

*** The student will normally start with Mathematics 115. Certain programs may require other courses as determined in consultation with the advisor.

SOPHOMORE YEAR

Fall Semester	*Credits*
*Literature	3
Social Science	3
**Natural Science	3 or 4
Philosophy 205	
Problems and Types of Philosophy	3
Elective	3
Physical Education	1
MS 201 Military Science II	
or	
AS 221 Air Science II	1
	17 or 18

Spring Semester	*Credits*
Literature	3
Social Science	3
Natural Science	3 or 4
Elective	3
Elective	3
Physical Education	1
MS 202 Military Science II	
or	
AS 222 Air Science II	1
	17 or 18

* English 261, 262, 265, 266, English 468 may be substituted for English 265; Modern Language 301, 302.

** Biological Science 100, followed by an appropriate course in biology; Physics 211, 212, 221; Chemistry 101, 103; or Geology, (MIG) 120, 220, 222.

JUNIOR AND SENIOR YEAR

Aside from one semester of the History of Science or the Philosophy of Science (History 422; Philosophy 405), the work of the last two years is divided between the major, of not to exceed 30 credits in advanced courses, and electives, 12 credits of which must be outside the major department. These courses are selected in consultation with the advisor. The total graduation requirement is 128 credits.

Bachelor of Science

The curriculum leading to the degree of Bachelor of Science features a double concentration: one in the liberal arts and another in a basic science, mathematics or technology. It will be to the advantage of the student entering this program to present at least four units of mathematics upon entrance, as well as two units of a modern foreign language.

ECONOMICS

Professor ERNST W. SWANSON, *Head of the Department*

Professors:
E. A. FAILS, B. M. OLSEN, T. W. WOOD

Associate Professors:
A. J. BARTLEY, L. A. DOW, GERALD GARB, CLEON HARRELL

Assistant Professors:
M. M. EL-KAMMASH, W. R. HENDLEY, W. J. STOBER, O. G. THOMPSON, C. H. UFEN, J. WILSON

Special Lecturers:
COY BURCHFIELD, J. R. DRUMMY, GEORGE MARSH, R. L. SHAW

Instructors:
W. E. CULLISON, M. A. HUNT, T. C. TAYLOR, C. B. TURNER

Adjunct Professor:
D. R. DIXON

The subject of economics is the nature of economic processes and the economic and social structure within which they develop. The candidate for the Bachelor of Arts degree in economics is taught to deal with the changing problems of the times. The objectives of the program set before him are: a) to impart to him a grasp of human behavior under economic change; b) to teach him how to analyze changing economic structure through economic models and equations; and c) to confront him with solutions to contemporary issues and with the foundations of socioeconomic policy.

Programs leading to the degree of Bachelor of Science with concentrations in economics are also offered.

Finally, several courses have been designed primarily for students engaged upon a program for advanced degrees in the technical schools.

The variety of courses in the Department of Economics is such that any student may find concentrations in several possible areas.

a) A concentration in *economic theory and analysis.* Suggested courses are: Competition, Monopoly, and Public Policy; Labor Problems; Evolution of Economic Ideas; and Economic Dynamics.

b) A concentration in *quantitative economics.* Suggested courses are: Economic Decision Processes; Economic Dynamics; Econometrics; Linear Programming; and Industry Studies.

c) A concentration in *industrial economics:* Accounting Analysis, I and II; Marketing Methods; Introduction to Production Costs; Industrial Management; Personnel Management; Corporation Finance.

d) A concentration in *economic development and growth:* Economic Decision Processes; Economics of Growth; Economic Forecasting; International Economics; and Economic Dynamics.

ENGLISH

Professor LODWICK HARTLEY, *Head of the Department*

Professors:
A. M. FOUNTAIN, H. G. KINCHELOE, J. SUBERMAN, R. G. WALSER

Associate Professors:
E. DANDRIDGE, P. H. DAVIS, H. ELDRIDGE, B. G. KOONCE, F. MOORE, G. OWEN, E. H. PAGET, D. J. RULFS, A. B. R. SHELLEY, L. H. SWAIN, P. WILLIAMS, R. B. WYNNE

Assistant Professors:
L. CHAMPION, J. EASLEY, R. GOLDSMITH, M. HALPEREN, S. J. HARMON, A. S. KNOWLES, C. W. MARTIN, J. PORTER, W. TOOLE, R. B. WHITE

Instructors:
L. BETTS, P. BLANK, H. GRIFFIN *(Special Lecturer)*, H. HARGRAVE, M. HAWTHORNE, E. HOLLAHAN, D. KESTERSON, H. PEARCE, N. RICH, R. SANDERLIN, M. UPCHURCH, T. WALTERS, M. WILLIAMS *(Special Lecturer)*

The Department of English offers both basic and advanced courses in three areas: composition, speech, and literature. The freshman course, which is common to all curricula and prerequisite to all advanced courses in English, is designed to give intensive training and practice in written communication, plus an introduction to literary types. Courses in business, scientific, and creative writing and in speech are offered both to meet course requirements in special curricula and to provide electives for interested students. Advanced courses are available for a major in literature in the Bachelor of Arts program, as well as for areas of concentration in literature and in communications in the Bachelor of Science program.

For the English major in the Bachelor of Arts program the student must schedule 30 semester hours beyond the usual 6 hours in freshman composition. Basic requirements include the sophomore survey of English literature, a course in Shakespeare, and at least one course in American writers. Beyond these courses, the student may pursue his special interests within the limits of two recommended categories. In the final semester, a special seminar will serve as a capstone to his study. For a teaching certificate, 18 hours in professional courses and practicum must be included.

For students electing the Bachelor of Science program with English as an area of concentration, eight courses and seminars above the basic freshman and sophomore courses will be selected with the aid of departmental advisors.

GEOLOGY

Instruction in geology is provided by the Department of Mineral Industries in the School of Engineering. Introductory courses may be elected to give the student an appreciation of his natural environment

and of the dynamic processes by which present conditions have been reached. They supply a background for understanding the biologic world and the distribution of mineral wealth.

Geology may be selected as a major field of study for the Bachelor of Arts degree. In addition to the school-wide requirements, this program comprises 30 semester hours credit in geology. Supporting courses in chemistry, mathematics, and physics are also stipulated; introductory biological science is recommended.

HISTORY AND POLITICAL SCIENCE

Professor P. W. EDSALL, *Head of the Department*

Professors:
W. J. BLOCK, M. L. BROWN, F. V. CAHILL, J. T. CALDWELL, A. HOLTZMAN, STUART NOBLIN, L. W. SEEGERS

Associate Professors:
L. W. BARNHARDT, B. F. BEERS, R. W. GREENLAW

Assistant Professors:
M. S. DOWNS, C. F. KOLB, O. H. ORR, JR., STANLEY SUVAL

Instructors:
L. E. BENNETT, J. C. FARRELL, J. H. GILBERT

An understanding of the historical background of our times and of political principles, systems, processes, and behavior is expected of the educated man. The Department of History and Political Science makes it possible to gain this understanding by offering students in the School of Liberal Arts the opportunity to major or concentrate in either discipline, by giving some specially designed courses required in the curricula of other schools, and by providing a considerable range of courses open to election by all students in the University. While most of the offerings in history and political science are intended for undergraduates, the department gives some graduate courses which may be built into the programs of students working for advanced degrees. It also participates in the Fort Bragg program and cooperates with the Division of General Extension by making selected courses available to adults who do not reside on the North Carolina State campus.

MAJOR IN HISTORY

B.A. Program

A major in history involves thirty hours beyond HI 245-246, which is required for all B.A. students in the School of Liberal Arts. All history majors will be required to take two semesters of United States history and the senior seminar, HI 491-492. The United States history requirement will usually be satisfied by taking HI 251-252, but more advanced courses in the American field may be substituted by special

permission of the department. All other major courses must be at the 300 level or above.

CONCENTRATION IN HISTORY

B.S. Program

A concentration in history will involve eighteen additional hours of course work beyond HI 245-246 plus the senior seminar, HI 491-492. Of the eighteen hours, six must be in United States history, normally HI 251-252 unless special departmental permission is given to substitute more advanced courses in the American field.

MAJOR IN POLITICAL SCIENCE

B.A. Program

A major in political science will involve thirty hours. Required in the major are PS 201, The American Governmental System; PS 491-492, Seminar in Political Science; and a course in political theory. Except for PS 202, County and Municipal Government, all elective major courses must be at the 300-level or above. The department reserves the right to require its major students to take supporting work in other social sciences, including psychology, and in statistics.

CONCENTRATION IN POLITICAL SCIENCE

B.S. Program

A concentration in political science will involve eighteen hours of course work in the discipline plus the senior seminar, PS 491-492. PS 201, American Government System, is required. Except for PS 202, County and Municipal Government, all other courses elected in the concentration must be at the 300 level or above.

MODERN LANGUAGES

Professor G. W. Poland, *Head of the Department*

Professor:
E. M. Stack

Associate Professors:
F. J. Allred, S. T. Ballenger

Assistant Professors:
Ruth B. Hall, H. L. Titus

Instructors:
B. S. Howard, S. Kitchin, V. Prichard, E. F. Ritter, S. E. Simonsen, R. S. Shain

The Department of Modern Languages provides instruction in French, German, Spanish, Italian and Russian as well as special

instruction in English for foreign students. In addition to elementary grammar, courses are offered in the literature and culture of these language areas. A language laboratory provides further opportunity to students to improve aural-oral skill in a particular language. There are also special courses for graduate students preparing to fulfill language requirements for advanced degrees. For graduate students already having a reading knowledge of a foreign language, examinations for certification are given.

PHILOSOPHY AND RELIGION

Professor W. N. HICKS, *Head of the Department*

Professor:
P. A. BREDENBERG

Associate Professors:
W. L. HIGHFILL, J. L. MIDDLETON

Assistant Professor:
W. C. FITZGERALD, JR.

Instructor:
W. KURYLO

The department provides elective courses for students in the several professional schools and, in addition, basic courses in philosophy and religion that are supplementary to the curricular programs of the School of Liberal Arts.

Philosophy courses are offered in the areas of logic, epistemology, ethics, history of philosophy, philosophy of art, philosophy of education, philosophy of religion, and philosophy of science. Religion courses are offered in the areas of Bible in the light of modern scholarship, Christian ethics, religious movements and trends in the United States, and world religions.

The department offers two degree programs: (1) a major in philosophy leading to the B.A. degree, and (2) a program leading to the B.S. degree with concentration in philosophy.

The major in philosophy consists of a minimum of 27 credits beyond the introductory course, Philosophy 205. Required courses include: two semesters in history of philosophy, Philosophy 320 and 321; one semester in the theory of knowledge, Philosophy 407; one semester in logic, either Philosophy 201 or 401; two senior seminars, Philosophy 490 and 491; and a senior essay, Philosophy 499. The student will elect a minimum of six further credits in philosophy in consultation with his advisor. A total of 128 credits is required for graduation.

The concentration in philosophy for the B.S. degree consists of 24 credits in philosophy.

PHYSICAL EDUCATION

Professor PAUL H. DERR, *Head of the Department*

Professor:
W. E. SMITH

Associate Professors:
J. B. EDWARDS, A. M. HOCH, HAROLD KEATING, J. F. KENFIELD, JR.

Assistant Professors:
J. L. CLEMENTS, N. E. COOPER, W. R. LEONHARDT, J. H. LITTLE, F. J. MURRAY, W. M. SHEA, W. H. SONNER

Instructors:
B. L. NUTTER, M. S. RHODES, BETTY A. SMALTZ, R. G. WEAVER

North Carolina State requires four semesters in physical education to be taken consecutively during the freshman and sophomore years. Each semester of physical education is divided into two eight-week terms. All courses are grouped under one of two headings, Prescribed Courses or Controlled Elective Courses. Insofar as staff, facilities, and allotment of time will permit, each student is directed into courses which will best meet his individual needs.

PRESCRIBED COURSES

Prescribed courses are designed to meet the needs of the individual student as determined by tests. The prescribed courses offered are: Hygiene, Beginning Swimming I, Beginning Swimming II, Fundamental Sports I, Fundamental Sports II, Soccer, Gymnastics I, Restricted Activity I, and Restricted Activity II.

CONTROLLED ELECTIVE COURSES

All elective courses are grouped under one of the following areas: Aquatics, Developmental Activities, Individual Sports, or Team Sports. All courses are listed under one of these four areas.

Each student must elect one course from each area before he is permitted to take a second course in either area. After the student has taken one course from each of the four areas, he may elect courses without regard for areas, but he cannot repeat any course which he has taken for credit.

PSYCHOLOGY

(Also see Education)

Professor HOWARD G. MILLER, *Head of the Department*

Professors:
K. L. BARKLEY, J. O. COOK, H. M. CORTER, S. E. NEWMAN

Associate Professors:
N. M. CHANSKY, J. C. JOHNSON, P. J. RUST

Assistant Professors:
T. S. BALDWIN, E. E. BERNARD, D. W. DREWES, G. S. LEVENTHAL, R. E. LUBOW

Adjunct Assistant Professor:
GILBERT GOTTLIEB

Courses in psychology are designed to promote a broad understanding of behavior as a science and to cultivate the skills which may be useful in dealing with human beings in social, educational, industrial or other situations. The department offers courses of interest to students in all schools of the University.

UNDERGRADUATE PROGRAM

A major in psychology leading to the Bachelor of Arts degree is offered as a part of the liberal arts program. The student is required to take twenty-seven hours in psychology, plus a three hour statistics course. Of the twenty-seven hours in psychology, twenty-one are required, namely, Psychology 200, 210, 300, 310, 320, and the seminar series Psychology 491 and 492. In addition, two elective courses in psychology at or above the 300 level are required.

In courses outside the major the general requirements for the liberal arts degree prevail except that the following courses are required for psychology majors: BS 100, MA 201 or 211, MA 215, and a two semester sequence in one of the physical sciences—physics, chemistry, or earth science.

GRADUATE STUDY

Graduate work is offered in the Department of Psychology leading to the degree of Master of Science in Psychology with options in industrial psychology, experimental psychology, school psychology, and human factors.

SOCIAL STUDIES

Professor G. A. GULLETTE, *Head of the Department*

Professors:
C. I. FOSTER, J. R. LAMBERT

Associate Professors:
W. F. EDWARDS, R. N. ELLIOTT, R. S. METZGER

Assistant Professor:
J. C. WALLACE

Instructors:
R. V. BRICKELL, J. R. COLEMAN, R. M. CORNISH

The Department of Social Studies draws its staff from the various fields of the humanities and the social sciences. It offers courses specially designed to contribute to the liberal education of students whose major interests are in science or technology.

SOCIOLOGY AND ANTHROPOLOGY

Professor Selz C. Mayo, *Head of the Department*

Professors:
E. H. Johnson, S. R. Winston

Associate Professor:
H. D. Rawls

Assistant Professors:
Herbert Collins, E. C. Lehman, D. V. McCalister

The general aims of the department are to provide a sound and highly developed undergraduate major which will lead to a rewarding and satisfying professional career; to provide other students with an opportunity to understand more fully the social world in which they live in relation to their own vocational interests; and to provide an opportunity for a few exceptional students to pursue a graduate program in sociology. Majors will find a wide range of careers open to them in both the public and private sectors of our society. Students majoring in the various technological areas find that courses in sociology and anthropology supplement and enhance their training in the technologies.

BACHELOR OF ARTS DEGREE IN SOCIOLOGY

The following departmental requirements must be met by all students majoring in sociology: a minimum of thirty hours in the major field including SOC 202, Principles of Sociology; SOC 315, Social Thought; SOC 416, Research Methods; a minimum of five electives on the three hundred or higher level in sociology; and two semesters of SOC 490, 491, Senior Seminar. The department requires ANT 252, Cultural Anthropology, at least one course in psychology, and one elective in statistics.

GRADUATE STUDY

The cooperative graduate program is administered through the Department of Rural Sociology. Students may pursue courses of study leading to both the master's and doctor's degrees.

SCHOOL OF PHYSICAL SCIENCES AND APPLIED MATHEMATICS

Arthur Clayton Menius, Jr., *Dean*
Wesley Osborne Doggett, *Assistant Dean*

The current demand for high caliber scientists, mathematicians, and engineers continues to outpace the national supply. This imbalance

has been a contributing factor in the growth of the School of Physical Sciences and Applied Mathematics since its inception in 1960. The School performs a three-fold function: the training of potential scientists and mathematicians; the technical support of curricula in Agriculture and Life Sciences, Design, Education, Engineering, Forestry, Liberal Arts, and Textiles; and research in physical sciences and mathematics. These activities are carried out by the four academic departments of Chemistry, Experimental Statistics, Mathematics, and Physics. The Computing Center and the Department of Physical Sciences Research are also in the School of Physical Sciences and Applied Mathematics. The graduates of the School are actively recruited for technical and administrative positions in industrial research and development, teaching, non-profit research organizations, and government laboratories. Today's scientific age offers a lifetime of challenges and opportunities to students who choose these curricula of study. A large percentage of the graduates undertake advanced study leading to the Master of Science and Doctor of Philosophy degrees.

The high-school student with an above average performance in mathematics, chemistry, or physics, and a basic interest in natural phenomena and their mathematics description, is encouraged to consider a career in physical sciences or mathematics. Both ability and motivation are essential prerequisites for successful completion of the bachelor's degree requirements. The School has consistently attracted outstanding students, as evidenced by the fact that approximately 40 percent of its students graduate with honors or high honors.

FACILITIES

The offices of the School of Physical Sciences and Applied Mathematics are located in the recently completed seven-story General Laboratory Building, together with the Departments of Physics and Experimental Statistics. Specially designed lecture-demonstration classrooms and basic and intermediate laboratories for physics are located in this building. The adjoining Harrelson Hall, with its 77 classrooms has as one of its occupants the Department of Mathematics, and provides additional classroom space for the School. Facilities for chemistry instruction are provided in Withers Hall, a four-story structure near the center of campus. Funds have been appropriated for a new Physical Sciences Building, which will be under construction in 1965. Physics research laboratories are located also in Daniels Hall, and in the Nuclear Science Laboratory building.

The School is fully equipped for instruction and research. Special equipment and laboratories associated with the School include a complete radiochemistry laboratory; a one-million volt Van de Graaff accelerator; two analog computers, GEDA and Donner; an IBM 1410 digital computer, and an IBM 1620 digital computer, supplemented by access to the UNIVAC 1105 at the University of North Carolina Computation Center at Chapel Hill; a plasma physics laboratory; a laser research laboratory; a Varian Associates HA-100 high resolution

nuclear magnetic resonance spectrometer; an upper atmospheric laboratory; a biomathematics and biophysics laboratory which includes a LINC III analog-digital computer and other supporting equipment; undergraduate and graduate desk computing laboratories equipped with the most modern machines; and an ultraviolet-infrared-visible spectroscopic laboratory. Other facilities on the campus available for teaching and research are an RCA electron microscope, a heterogeneous nuclear reactor designed for operation at 100 kilowatts, complete X-ray laboratories with diffraction and radiographic equipment, and precision instrument shops.

CURRICULA

The School offers undergraduate programs of study leading to the Bachelor of Science degree, with a major in chemistry, physics, applied mathematics or experimental statistics. The four curricula have essentially a common freshman year, thereby enabling a student to change, without loss of time, from one department to another in the School during the freshman year. A year of foreign language is required of all students. At least one course each semester must be selected from the offerings of the School of Liberal Arts. These courses serve the dual purpose of developing the student's communication skills and helping him become a responsible citizen. Courses in biochemistry and biophysics are available. Courses in computer science are also given regularly.

SHORT COURSES AND INSTITUTES

The School of Physical Sciences and Applied Mathematics offers several short courses and specialized institutes throughout the academic year and during the summer months in chemistry, physics, mathematics, and statistics for high-school students, high-school teachers, and college professors. For more information, write to the dean of the School.

In addition, certain regular courses may be taken for credit through correspondence or at the Evening College of the Division of General Extension in Raleigh, Charlotte, or in the Greensboro-Burlington-Winston-Salem area. For a listing of these courses, write to the Division of General Extension at Raleigh.

SUPERIOR STUDENT AND HONORS PROGRAMS

For several years, exceptional students have been selected to participate in the Superior Student Program during their freshman and sophomore years. Enriched courses in mathematics, chemistry, physics and English have been developed specifically for the participants in this program. At the beginning of the junior year, the most promising students are invited to enter the Honors Program. In this program, advanced students may select special courses, participate in under-

graduate research, and receive some graduate credit toward the Master of Science degree during the senior year.

Well-prepared students entering the School may seek advanced placement in mathematics, chemistry, or physics by passing qualifying examinations.

STUDENT ACTIVITIES

In addition to the University-wide extra-curricular activities and honorary organizations, the School of Physical Sciences and Applied Mathematics has student chapters of the following professional and honorary organizations: Sigma Pi Sigma; American Institute of Physics; Pi Mu Epsilon; The American Chemical Society; and the Mathematics Club.

The Science Council, which is composed of elected students from the School, sponsors several social activities, participates in technical exhibitions, and publishes *The Scientist.*

GRADUATE STUDY

The Master of Science degree, with a major in chemistry, experimental statistics, applied mathematics, or physics, and both the Master of Experimental Statistics and the Master of Applied Mathematics are offered. The Doctor of Philosophy degree is available in biochemistry, chemistry, experimental statistics, applied mathematics, and physics. The graduate programs are described in the Graduate School Catalog.

FRESHMAN YEAR IN ALL PHYSICAL SCIENCES AND APPLIED MATHEMATICS CURRICULA

Fall Semester	*Credits*
CH 101 General Inorganic Chemistry	4
or	
CH 105 Principles of Chemistry I	4
and	
CH 106 Laboratory Techniques I	1
ENG 111 Composition and Rhetoric	3
MA 102 Analytic Geometry and Calculus I	4
Physical Education	1
MS 101 Military Science I	
or	
AS 121 Air Science I	1
Humanities	3
or	
Natural Science	4
PSM 100 Orientation	0
	16 or 17

Spring Semester	*Credits*
CH 103 General and Qualitative Chemistry	4
or	
CH 107 Principles of Chemistry II	4
and	
CH 108 Laboratory Techniques II	1
ENG 112 Composition and Reading	3
MA 201 Analytic Geometry and Calculus II	4
Physical Education	1
MS 102 Military Science I	
or	
AS 122 Air Science I	1
PY 205 General Physics I	4
or	
Natural Science	4
or	
Humanities	3
	16, 17 or 18

The total number of hours required for graduation is to be a minimum of 135 hours which includes 8 hours of military science and physical education. Twenty-one semester hours are to be required in the humanities, exclusive of Freshman English. An additional requirement is one modern language.

CHEMISTRY

Professor RALPH CLAY SWANN, *Head of the Department*

Professors:
G. O. DOAK, R. H. LOEPPERT, W. J. PETERSON, W. A. REID, C. C. ROBINSON, H. A. RUTHERFORD, A. J. STAMM, P. P. SUTTON, J. A. WEYBREW, R. C. WHITE

Adjunct Professors:
V. T. STANNETT, M. E. WALL

Associate Professors:
C. L. BUMGARDNER, D. M. CATES, A. F. COOTS, L. D. FREEDMAN, F. W. GETZEN, C. E. GLEIT, L. A. JONES, G. G. LONG, R. C. PINKERTON

Assistant Professors:
T. J. BLALOCK, L. H. BOWEN, H. H. CARMICHAEL, K. M. DEARMOND, F. C. HENTZ, W. P. INGRAM, JR., M. L. MILES, C. G. MORELAND, W. P. TUCKER, G. H. WAHL, JR.

Instructors:
W. R. JOHNSTON, MRS. E. H. MANNING, J. W. MORGAN, G. M. OLIVER, MRS. G. J. SHAW, T. M. WARD

BIOCHEMISTRY FACULTY

Professors:
L. W. AURAND, G. MATRONE, S. B. TOVE

Adjunct Professor:
M. E. WALL

Associate Professors:
S. G. LEVINE, A. R. MAIN, E. C. SISLER

Assistant Professors:
F. B. ARMSTRONG, H. R. HORTON, J. S. KAHN

CURRICULUM

The curriculum in chemistry is designed to provide the student with the training in sciences and humanities required for entrance into graduate school or into industry as a professional chemist. The emphasis in the undergraduate curriculum is on thorough instruction and laboratory training in the basic areas of chemistry, supported by course work in mathematics, physics, and the humanities. Considerable flexibility in the program is provided through choice of the minor field and elective courses.

The curriculum meets the requirements of the American Chemical Society for the training of professional chemists.

* CHEMISTRY CURRICULUM

For the freshman year see page 199.

* Chemistry majors are required to take CH 105, CH 106, CH 107, and CH 108. The minor may be in any field closely related to chemistry, such as mathematics, physics, biological sciences, engineering, or science education. A total of four courses in two such areas may constitute a "split" minor. The minor field should be chosen in consultation with the faculty advisor prior to or during the junior year.

SOPHOMORE YEAR

Fall Semester	*Credits*
CH 221 Organic Chemistry I	4
MA 202 Analytic Geometry and Calculus III	4
PY 206 General Physics	4
ENG Elective	3
MS 201 Military Science II or AS 221 Air Science II	1
Physical Education	1
	17

Spring Semester	*Credits*
CH 223 Organic Chemistry II	4
MA 301 Differential Equations	3
PY 207 General Physics	4
ENG Elective	3
MS 202 Military Science II or AS 222 Air Science II	1
Physical Education	1
	16

JUNIOR YEAR

Fall Semester	*Credits*
CH 431 Physical Chemistry I	3
CH 432 Physical Chemistry Lab.	1
MLG 101 Elementary German	3
Minor	3
Humanities Elective	3
Free Electives	4
	17

Spring Semester	*Credits*
CH 433 Physical Chemistry II	3
CH 434 Physical Chemistry Lab.	1
CH 401 Systematic Inorganic Chemistry	3
MLG 102 German Grammar and Prose Reading	3
Minor	3
Humanities Elective	3
	16

SENIOR YEAR

Fall Semester	*Credits*
CH 411 Analytical Chemistry	4
CH 428 Organic Qualitative Analysis	3
Minor	3
Humanities Elective	3
Free Electives	4
	17

Spring Semester	*Credits*
CH 413 Analytical Chemistry II	4
Major	2
Minor	3
Humanities Elective	3
Free Electives	5
	17

GRADUATE STUDY

The Master of Science in chemistry and the Doctor of Philosophy degrees in chemistry and biochemistry are available. For additional information on these programs, consult the Graduate School Catalog.

EXPERIMENTAL STATISTICS

Professor D. D. MASON, *Head of the Department*

Professors:
R. L. ANDERSON, *Graduate Administrator*, C. C. COCKERHAM, A. H. E. GRANDAGE, R. J. HADER, D. W. HAYNE, H. L. LUCAS, JR., F. E. MCVAY, R. J. MONROE, J. A. RIGNEY, R. W. STACY, R. G. D. STEEL, H. R. VAN DER VAART, O. WESLER

Professor Emeritus:
GERTRUDE M. COX

Adjunct Professors:
A. L. FINKNER, W. A. HENDRICKS, D. G. HORVITZ

Associate Professors:
W. J. Hall, R. G. Petersen, C. H. Proctor, J. O. Rawlings, W. W. G. Smart, Jr., T. D. Wallace

Visiting Associate Professor:
J. C. Koop

Adjunct Associate Professor:
W. A. Glenn

Research Associate Technologist:
F. J. Verlinden

Assistant Professors:
B. B. Bhattacharyya, L. J. Herbst, L. A. Nelson, C. A. Rohde

Adjunct Assistant Professor:
S. Addelman

Research Assistant Technologist:
L. L. McKee

Assistant Statisticians:
S. J. M. England, V. A. Pace, B. J. Stines, F. T. Wang

Statistics is the body of scientific methodology which deals with efficient collection and presentation of experimental or survey data, and with the drawing of valid and reliable inferences from such data. Early development of statistics occurred in the biological and social sciences. In recent years statistical concepts and methodology have been found useful in virtually all areas of scientific endeavor.

The Department of Experimental Statistics at Raleigh is part of the Institute of Statistics, which also includes a Department of Biostatistics and a Department of Statistics at Chapel Hill. The Department of Experimental Statistics provides instruction, consultation, and computational services on research projects for other departments of all schools at North Carolina State including the Agricultural Experiment Station; the department staff are also engaged in an extensive program of research in statistical theory and methodology. This wide range of activities furnishes an excellent professional environment for training students in the use of statistical procedures in such fields as the physical, biological, and social sciences, and in industrial research, development, and engineering.

OPPORTUNITIES

Most fields of research, development, production, and distribution are seeking persons trained in statistical methods and theory. Research groups recognize the importance of incorporating sound statistical thinking in planning experiments and in analyzing and computing results. Industry relies on statistical methods to control the quality of goods in the process of manufacture and to determine the acceptability of goods already produced. Statistical procedures based on scientific sampling have become basic tools for making weather forecasts, crop and livestock estimates, business trend predictions, opinion polls and the like.

A graduate in statistics will find abundant employment opportunities that will be financially and intellectually rewarding.

EXPERIMENTAL STATISTICS CURRICULUM

Assuming BS 100 and PY 205 were elected during the freshman year, a typical program for the succeeding three years might be as follows:

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ST 311 or 361 Introduction to Statistics	3	ST 312 or 362 Introduction to Statistics	3
MA 202 Calculus II	4	ST 302 Machine Techniques for Data Processing	2
PY 208 General Physics	4	MA 301 Differential Equations	3
EC 201 Economics	3	ZO 201 Animal Life	4
MS 201 Military Science II or AS 221 Air Science II	1	EC 202 Economics	3
Physical Education	1	MS 202 Military Science II or AS 221 Air Science II	1
	16	Physical Education	1
			17

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ST 421 Basic Statistical Theory or ST 515 Experimental Statistics	3	ST 422 Basic Statistical Theory or ST 516 Experimental Statistics	3
Minor	3	Minor	3
Foreign Language	3	Major Elective	3
ENG 321 Scientific Writing	3	Foreign Language	3
PSY 200 Introduction to Psychology	3	ENG 231 Basic Speaking Skills	3
Humanities Elective	3	Humanities Elective	3
	18		18

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
ST 515 Experimental Statistics or ST 421 Basic Statistical Theory	3	ST 516 Experimental Statistics or ST 422 Basic Statistical Theory	3
Minor	3	Minor	3
Humanities Elective	3	Humanities Elective	3
Free Electives	7	Free Electives	6
	16		15

GRADUATE STUDY

The Department of Experimental Statistics offers work leading to the Master of Science, Master of Experimental Statistics, and Doctor of Philosophy degrees. Minor work may be taken in any of the wide variety of research programs on the campus. In addition, a cooperative arrangement with the Departments of Biostatistics and Statistics at Chapel Hill provides for minor work in health affairs and in mathematical statistics. Active participation in the graduate faculty by

several members of the staff of the Research Triangle Institute provides further strength of staff and a wider variety of research experience available to graduate students.

The department has at least one staff member who consults with researchers in each of the following fields and who conducts his own research on statistical problems which are encountered: the various agricultural sciences, quantitative genetics, industry and engineering, physical sciences, and social sciences. In addition, there is active research in the general fields of experimental design and sample surveys.

MATHEMATICS

Professor JOHN W. CELL, *Head of the Department*

Professors:
R. C. BULLOCK, J. M. CLARKSON, W. J. HARRINGTON, MAKOTO ITOH, JACK LEVINE, H. M. LIEBERSTEIN, C. G. MUMFORD, H. M. NAHIKIAN, *Graduate Administrator*, H. V. PARK, *Administrative Assistant*, HANS SAGAN, H. E. SPEECE, R. A. STRUBLE, H. R. VAN DER VAART, OSCAR WESLER, H. P. WILLIAMS, L. S. WINTON

Adjunct Professors:
A. S. GALBRAITH, LEONARD ROBERTS, H. M. TRENT

Associate Professors:
J. W. BISHIR, H. C. COOKE, A. R. NOLSTAD, D. M. PETERSON, H. A. PETREA, J. W. QUERRY, T. W. TING, G. C. WATSON, J. B. WILSON

Adjunct Associate Professor:
R. T. HERBST

Assistant Professors:
V. R. BRANTLEY, E. J. CANADAY, JOYCE CARAWAY, D. J. HANSEN, RUTH B. HONEYCUTT, KWANGIL KAH, C. F. LEWIS, *C. H. LITTLE, JR., R. A. MACKERRACHER, ARMSTRONG MALTBIE, L. B. MARTIN, JR., PETER SHAHDAN

Adjunct Assistant Professor:
J. G. BALDWIN

Instructors:
C. N. ANDERSON, DOROTHY L. BRANT, J. V. BRAWLEY, MARTHA J. GARREN, J. H. HEINBOCKEL, JAFAR HOOMANI, G. F. KNIGHT, JULIE G. MCVAY, CARLOTTA P. PATTON, T. G. PROCTOR, III, D. W. REID, J. A. ROBERTS, R. G. SAVAGE, J. L. SOX, G. S. SPEIDEL, JR., MARGARET J. STONE, D. B. TEAGUE

There is great need in industry and in the field of teaching for people trained in applied mathematics. The increasing use of both digital and analog computers and the shift to automation in industry have given rise to requirements for mathematics analysts and computer scientists. The Department of Mathematics offers opportunities in the elementary and advanced courses for the student to learn important concepts in mathematics and to apply these to situations in mathematically oriented areas.

*On leave 1964-65.

CURRICULUM

The curriculum for the Bachelor of Science degree in applied mathematics is designed to provide the student with a sound foundation in mathematics and at the same time to give him a reasonable acquaintance with some other area of science or engineering in which mathematics is applied. Required courses are relatively few in number so that the individual needs of the student are met more readily. The individual curriculum can be designed either to fit the needs of a student for a position in industry or to provide him with a strong foundation for future graduate work.

SOPHOMORE YEAR

Fall Semester	*Credits*
MA 202 Analytic Geometry and Calculus III	4
MA 251 Programming Laboratory I	1
PY 205 or 206 General Physics	4
English Literature	3
*ML 101 Modern Language	3
MS 201 Military Science II or AS 221 Air Science II	1
Physical Education	1
	17

Spring Semester	*Credits*
MA 252 Programming Laboratory II	1
MA 303 Differential Equations and Infinite Series	4
PY 207 or 208 General Physics	4 or 5
Humanity Elective	3
*ML 102 Modern Language	3
MS 202 Military Science II or AS 222 Air Science II	1
Physical Education	1
	17 or 18

JUNIOR YEAR

Fall Semester	*Credits*
MA 405 Introduction to Determinants and Matrices	3
MA 401 Topics from Advanced Calculus I or **MA 511 Advanced Calculus I	3
ST 371 Introduction to Probability and Statistics	3
***Minor	3
****Humanity	3
Free Elective	3
	18

Spring Semester	*Credits*
MA 403 Fundamental Concepts of Algebra	3
#Mathematics Elective	3
***Minor	3
****Humanity	3
Free Elective	6
	18

SENIOR YEAR

Fall Semester	*Credits*
#Mathematics Elective	6
***Minor	3
****Humanity	3
##Free Elective	4 or 5
	16 or 17

Spring Semester	*Credits*
#Mathematics Elective	3
***Minor	3
****Humanity	3
##Free Elective	6 or 7
	15 or 16

* The language chosen (French, German, or Russian) is subject to the approval of the department head.

** MA 511 is required but may be taken during a subsequent semester.

*** The minor field is, as a minimum, a four-course sequence from one other area, and these courses normally should exhibit the application of mathematics in this area. (At least one of the four should be at the level of differential equations or matrices.) They are not to include any course from this area which is otherwise applied in satisfying the requirements of this curriculum. This minor is to be chosen in consultation with the student's advisor prior to or during the junior year and this choice is subject to the approval of the department head.

**** These junior-senior humanities generally should be chosen from humanities offerings at the 300-level and above, or from modern language offerings beyond the required courses.

Mathematics electives are to be selected subject to prerequisites, at least one from each of the following categories:

I MA 401, 402, 512, 516, 517
II MA 513, 514, 524, 532
III MA 527, 528, 536, 537
IV MA 421, 541, 542

The minimum hourly requirement on free electives is such as will give a minimum total hour requirement of 135 semester hours.

GRADUATE STUDY

The faculty of the Department of Mathematics feels that a student entering the Graduate School to work toward a master's degree in applied mathematics should be well grounded in mathematics through two semesters of advanced calculus and two of modern algebra (or the equivalent). In addition, he should have a strong background in mechanics, physics, or in some other mathematically oriented area.

Minimum course requirements for the degree of Master of Science in applied mathematics are 30 hours, of which six to nine hours must be selected from a minor field which is usually some branch of engineering, physics, or statistics; in addition to the above requirements, the student must write a thesis and show a satisfactory reading knowledge of a foreign language. The requirements for the degree of Master of Applied Mathematics are 30 hours of course credits of which six to nine hours must be selected from a minor field (e.g., engineering, physics, or statistics); in addition, the student must write a brief paper which is submitted for departmental approval.

For more detailed information and for requirements for the Doctor of Philosophy degree see the Graduate School Catalog.

PHYSICS

Associate Professor J. T. Lynn, *Acting Head of the Department*

Burlington Professors:
Willard H. Bennett, Raymond L. Murray

Professors:
W. O. Doggett, H. C. Kelly, F. W. Lancaster, E. R. Manring, J. S. Meares, A. C. Menius, Jr., A. W. Waltner

Associate Professors:
W. R. Davis, J. D. Memory, R. F. Stanback

Assistant Professors:
E. J. Brown, G. C. Cobb, R. L. Dough, G. H. Katzin, D. H. Martin, M. K. Moss, J. Y. Park, R. R. Patty

Instructors:
Janice Bireline, H. L. Owen, G. W. Parker, P. S. Shieh

Physics is a fundamental science of observations, measurements, and the mathematical description of the particles and processes of nature. In addition to extending our basic knowledge of the universe, the science of physics provides an attack on problems of importance in modern technology. The variety of the contributions made by physicists is indicated by such typical recent activities as the discovery of

new particles of nature, the invention and use of new instruments to probe interplanetary space, the study of processes fundamental to the release of thermonuclear energy, the development of lasers, and research on missiles, satellites and space craft.

PROGRAMS

The physics department provides programs of study in fundamental physics and in several areas of specialization including nuclear physics, plasma physics, space physics, infrared spectroscopy, and laser studies.

OPPORTUNITIES

The demand for graduates with fundamental and specialized knowledge in physics has grown rapidly in recent years. The demands for scientists are currently greatest in the fields of nuclear physics and space science in which large research and development programs are in progress. Positions are available to qualified individuals in government laboratories, industrial research facilities, and universities.

GRADUATE STUDY

The Department of Physics provides programs of advanced study in physics leading to the Master of Science and Doctor of Philosophy degrees. A research thesis is required for each degree. A comprehensive understanding of classical and modern physics is stressed, with specialization possible in nuclear physics, infrared studies, plasma physics, space physics, and the theory of fields. Work in the student's minor field will generally be taken in other departments of the School of Physical Sciences and Applied Mathematics. Research facilities available include a 10-kilowatt heterogeneous reactor, a natural uranium sub-critical assembly, a one-Mev Van de Graaff accelerator, and high speed computing equipment. Plasma laboratories with precision shop equipment and laboratory facilities in the fields of spectroscopy and nuclear magnetic resonance are available. Among other experimental research projects are studies of high current ion streams, the simulation of space conditions, and the diffusion of neutrons using pulsed methods. A number of research and teaching assistantships are available to qualified graduate students.

PHYSICS CURRICULUM

For the freshman year see page 199.

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
PY 206 General Physics	4	PY 207 General Physics	4
MA 202 Analytic Geometry and Calculus III	4	MA 301 Differential Equations I	3
Modern Language	3	Modern Language	3
PS 201 The American Governmental System	3	Humanities Elective	3
		English Elective	3
MS 201 Military Science II or AS 221 Air Science II	1	MS 202 Military Science II or AS 222 Air Science II	1
Physical Education	1	Physical Education	1
	16		18

JUNIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
PY 411 Mechanics	3	PY 412 Mechanics	3
PY 414 Electricity and Magnetism	3	PY 415 Electricity and Magnetism	3
PY 410 Nuclear Physics I	4	SS 302 Science and Civilization	3
MA 511 Advanced Calculus I	3	Mathematics Elective	3
SS 301 Science and Civilization	3	Physics Elective	3
	—	Free Elective	3
	16		—
			18

SENIOR YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
SS 491 Contemporary Issues	3	PHI 405 Foundations of Science	3
Physics Electives	6	Physics Electives	6
Mathematics Electives	3	Free Electives	7
Free Electives	6		—
	—		16
	18		

COMPUTING CENTER

An IBM 1410 digital computer is located in the Computing Center in Nelson Textile Building. The computer, a card-tape system with 40,000 characters of core storage, is used for faculty and student research, and for instruction in scheduled credit courses and non-credit short courses.

Credit courses in computing are supplemented by use of the computer in courses offered by several departments and by a continuous offering of non-credit short courses.

Two IBM 1620 computers are available for use by several departments, and use of analog computers is included in many courses.

PHYSICAL SCIENCES RESEARCH

The Department of Physical Sciences Research of the School of Physical Sciences and Applied Mathematics was established in 1961 to promote research and research training activities sponsored by outside agencies, to administer sponsored research, and to assist in physical facilities planning, design, and the preparation of proposals for support from non-state sources. Research facilities are listed above.

SCHOOL OF TEXTILES

MALCOLM E. CAMPBELL, *Dean*

JAMES W. KLIBBE, *Academic Coordinator*

The manufacture of textiles has become one of the world's leading industries. North Carolina's textile industry now ranks first in the

nation in terms of employment and value of manufactured products. Furthermore, the textile industry of the State and the area is broadly diversified, ranging from the production of man-made fibers to finished garments, from cotton spinning mills to finishing plants, from woven goods to all types of knitted materials, and from suppliers to machine manufacturers.

Because of the tremendous expansion in the scope of textiles it has become necessary to utilize the talents of the chemist, the physicist, the engineer, the businessman, as well as the traditional spinner, weaver, and dyer.

The School of Textiles offers several programs at both the undergraduate and graduate levels in the applied sciences underlying the production and finishing of textile products. Textile research supplements and supports graduate study.

The purpose of the School is fourfold: to educate men and women for professional service in all phases of the textile industry; to develop their capacities for intelligent leadership; to aid in the economic development of the textile industry; and to cooperate with the textile industry in improving, through scientific research, manufacturing efficiency and the quality and value of manufactured products.

In the educational program, for administration, the School of Textiles is organized into three departments: Textile Technology, Knitting Technology, and Textile Chemistry.

CURRICULA

The School of Textiles offers two basic four-year curricula, textile technology and textile chemistry. After the freshman year these two programs differ; however, there is sufficient similarity in the first year to permit the student to defer the final decision as to his major field of study until the end of the freshman year.

A program is offered by the School to permit the student with a B.S., A.B., or B.A. degree from an accredited college or university to complete the requirements for a Bachelor of Science degree in textile technology after the satisfactory completion of one year of study.

The over-all program of the textile technology curriculum includes course work in the basic sciences and humanities as well as in the professional area of textiles. The arrangement of stems within the curriculum permits for specialization in various areas which lead in one direction to a high concentration of work in the basic sciences and in the other direction to greater depth in the study of economics. The various avenues of selection open to the students are as follows, with specialization as indicated: fiber and yarn technology, fabric technology, general textiles, knitting technology, and textile economics.

The latter program provides substantial depth in the fundamentals of economics as well as work in the basic sciences, humanities, and professional textile areas. It is believed that this program provides a firm foundation on which to develop business skills.

Textile chemistry is designed to give the student a fundamental education in chemistry with special emphasis on the application of this science to textiles. The textile chemistry curriculum places emphasis on chemical fundamentals so that those students who complete this program with a high degree of excellence are adequately prepared for graduate study either in pure or applied chemistry. Similarly, students who complete the program in any one of the stems in textile technology with a high degree of excellence would be acceptable for graduate study in many different areas.

Inasmuch as the professional work in textiles is concentrated to a great extent in the last two years of the student's program, it is quite possible for students from either junior colleges or other institutions of higher learning to transfer to the School of Textiles with a minimum loss of time.

DEGREES

By mutual agreement between the faculties involved, candidates for the Doctor of Philosophy degree in other schools of this institution may specialize in essentially textile related subjects. In such cases it is often logical for the research involved to be done in the School of Textiles.

Upon completion of programs in either textile technology or textile chemistry, the degree of Bachelor of Science is conferred.

A Master of Textile Technology degree is offered. The degree of Master of Science in textile technology or in textile chemistry is also offered. The granting of this degree requires the satisfactory completion of a minimum of a year of graduate study, in residence, and the submission and acceptance of a thesis based upon a research project. For general requirements, consult the Graduate School Catalog.

FACILITIES

The Nelson Textile Building, erected in 1939 and greatly enlarged in 1950, was designed to coordinate teaching and laboratory facilities. It houses one of the most modern and best-equipped textile institutions in the world. The Department of Textile Chemistry is housed in the Clark Laboratories, one hundred yards south of the Nelson Textile Building.

OPPORTUNITIES

Technological advances in textile fibers and manufacturing techniques have created a tremendous demand for men technically trained in textile colleges. For the past several years, the School of Textiles has had a demand for graduates greater than it could supply. Its graduates have entered the textile industry at salaries equal to or better than those offered in many other industries.

Graduates of the School are equipped to enter many fields related to textiles, such as manufacturing, sales or research; and alumni of the

school hold responsible positions in each of these fields. Many are now mill presidents or general managers.

Some of the specific fields selected by North Carolina State textile graduates are production of yarns, production of woven and knitted fabrics, dyeing and finishing, industrial engineering, quality control, designing, styling, merchandising, converting, research, cost and production control, and sales of equipment and materials to the textile industry.

To assist in the placement of students and alumni and to facilitate interviews by textile firms, the School maintains a full-time placement director.

INSPECTION TRIPS

For certain of the textile courses offered, it is desirable for the student to see the manufacturing process under actual operating conditions. When possible, trips are arranged for student groups to visit outstanding manufacturing plants. Participation in the trips is required; transportation costs and other travel expenses, while held to a minimum insofar as possible, must be paid by the student.

SHORT COURSES

It is the policy of the School to offer course training for textile mill men who have a limited amount of time to spend at the School. These courses are offered when a sufficient demand for them develops. The subject matter is selected to meet the needs of the group.

DISTINGUISHED PROFESSORSHIPS

The School of Textiles has four sponsored professorships. These are made possible by funds contributed to the North Carolina Textile Foundation, Inc., and especially designated to pay a part of the annual salary of the professor selected to fill the position.

The four professorships, together with the year of establishment and the name of the incumbent for each, are as follows:

Burlington Industries Professorship of Textiles—1946, Dame S. Hamby, professor of textiles. Department of Textile Technology.

Chester H. Roth Professorship of Knitting Technology—1948, William Edward Shinn, professor of textiles and head of Department of Knitting Technology.

Abel C. Lineberger Professorship of Textiles—1948, Elliot Brown Grover, professor of textiles and head of Department of Textile Technology.

Edgar and Emily Hesslein Professorship of Fabric Development—1948. (Open)

KNITTING TECHNOLOGY

Professor WILLIAM E. SHINN, *Head of the Department*

Assistant Professor:
H. M. MIDDLETON, JR.

Instructor:
PETER LI

In recognition of the great importance of knitting and the other needle arts in the industrial life of this section, the Department of Knitting Technology makes available to this branch of the textile industry, personnel trained in the fundamentals and practices underlying the production of knitted textiles.

CURRICULUM

Knitting technology students follow the textile technology curriculum and elect Stem 4. For a list of the curriculum by years see pages 220-222.

FACILITIES

The laboratories of the knitting technology department, organized and equipped for instruction in many phases of the knit-goods industry, are grouped as follows:

Seamless Hosiery

Equipment for instruction in seamless hosiery production includes representative types of machines arranged in two groups. The more elementary types, including ribbers and plain hosiery machines with the elementary attachments such as stripers, reverse plating and rubber top attachments, are arranged together for beginning students. The more advanced types are grouped together for advanced students. This line includes advanced rib type machines, Komets, Banner Wrap Reverse, several types of float stitch machines, and machines for the manufacture of hosiery with solid color patterns.

Nylon Hosiery

This section is equipped with full-fashioned hosiery knitting machines of modern types in 51-gauge, 54-gauge, and 66-gauge. There is provided also three 400-needle women's nylon hosiery machines of the circular type. This equipment forms the basis for instruction in hosiery manufacture. Equipment for the looping and seaming of hosiery, for pre-boarding, dyeing and finishing of fine hosiery is provided in separate rooms.

Circular Knitwear

A wide assortment of large diameter fabric knitting machines is provided for demonstration and instruction in the production of cloth

for both underwear and outerwear. This group includes latch needle and spring needle types for jersey, rib, interlock and Jacquard double knit fabric.

Garment Cutting and Seaming

A laboratory for experimental garment design and manufacture has been set up with modern power cutting equipment and many types of industrial sewing machines for producing garments for both outerwear and underwear. This unit is supplemented by knit goods finishing equipment located in the hosiery and knitwear finishing laboratory.

Warp Knitting, Flat Knitting

The laboratories include eight warp knitting machines of the tricot and raschel types. These machines furnish the basis for instruction in the design, analysis, and production of warp knitted fabrics. A collection of fabrics and several winding and warp preparation machines make it possible to process a variety of materials. Flat machines of the V-bed and links-and-links class are employed for instruction in the production of heavier knitwear such as sweaters.

Knit Goods Finishing

Devoted entirely to experimental work in hosiery and knit goods finishing, this laboratory contains modern equipment for pre-boarding, dyeing and finishing machinery, a knit goods calendar for finishing knitted tubing, and a fabric brush.

TEXTILE CHEMISTRY

Professor HENRY A. RUTHERFORD, *Head of the Department and Director, Chemical Research*

Professors:
K. S. CAMPBELL, D. M. CATES, *Associate Director, Chemical Research*

Associate Professors:
T. H. GUION, A. C. HAYES

Instructor:
ROSA D. KIRBY

Adjunct Professors:
L. L. HEFFNER, W. R. MARTIN, JR.

The purpose of the Department of Textile Chemistry is to instruct students in the chemistry of natural and synthetic fibers, and in the theory and practice of scouring, bleaching, dyeing, finishing and printing of yarns and fabrics; to conduct laboratory experimental work demonstrating the principles set forth in lecture periods; to cooperate with the mills of the State in solving problems relating to the wet processing of textile materials.

CURRICULUM

In the senior year, the student is given the option of electing a course of study which includes physical chemistry or may in its place elect a stem of courses in textile technology. In the latter, three areas are provided which furnish depth in quality control, fabric technology, or yarn technology. A student may elect also a three-course sequence of a minimum of nine semester hours in psychology, industrial engineering, or from the School of Liberal Arts.

Students who expect to pursue a course of graduate study are urged to take the chemistry option. The technology option is primarily for students who expect to go into production.

In either option, the curriculum places emphasis on the fundamentals of chemistry. Adequate background in social sciences and humanities is also provided.

GRADUATE STUDIES

A master's degree in textile chemistry is offered for the satisfactory completion of one year of graduate study in residence. The program in textile chemistry and its related area, polymer science, is intended to provide professional training at the graduate level. The student with a bachelor's degree in chemistry or chemical engineering will generally have the academic background to undertake it. The student with a major in physics may desire to enroll in one or two undergraduate courses in chemistry to erase certain deficiencies.

Five courses, that are described in the section on Description of Courses, (TC 403, 404; TC 561, 562; TC 605; and TC 606), are the core of the education plan at the graduate level. The selection of courses beyond the ones mentioned depends on the student's interest and the nature of his thesis research. The objective is to stimulate basic research and to train scientists in the general field of fiber and polymer chemistry, with proper emphasis on the supporting sciences. Although fiber-forming polymers are emphasized, the program is broad in scope, providing an opportunity for training and research in general principles in the polymer field, as well as advanced study in chemistry, physics, and mathematics.

Fellowships and assistantships are available for qualified students.

FACILITIES

Facilities available in textile chemistry follow:

Dyeing Laboratory

This is a complete laboratory with generous provision for bench space, equipment storage facilities, etc. It is used for all laboratory work dealing with chemical properties of textiles, dye synthesis, color matching and all types of dyeing.

Dye House

In this room is assembled a collection of dyeing and finishing machinery for instructional and experimental purposes. Obtained over the last few years, the equipment includes a singeing machine, a padder, a continuous dyeing range of the pad-steam type, a Williams unit, a duPont-type continuous bleaching unit, four package dyeing machines, a dye beck, dye jig, rotary hosiery dyeing machine, piece goods dyeing and finishing units utilizing dry cans, enclosed tenter frame and a continuous loop drying and curing unit supplied with both steam and gas-fired heat sources and a laboratory calendar.

RESEARCH AND TEXTILE CHEMICAL ANALYSIS

Nine laboratories equipped for chemical research on fibers and on textile chemical specialties are available for use by advanced undergraduate students and graduate students working on special problems and for research. Equipment is available for ultra-violet, visible, and infrared spectroscopy, reflectometry, colorimetry, viscometry, differential thermol analysis and thermal gravimetric analysis. Common testing equipment used for the evaluation of the physical properties of textile materials and for determining the color-fastness, wash-fastness of dyed fibers and fabrics is also available.

TEXTILE CHEMISTRY CURRICULUM

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
TX 221 Fundamentals of Textiles	4	TX 261 Fabric Structure	4
CH 105 Chemistry	4	CH 107 Chemistry	4
MA 111 Mathematics*	4	MA 112 Mathematics	4
ENG 111 English	3	ENG 112 English	3
**MS 101 Military Science I or		MS 102 Military Science I or	
**AS 121 Air Science I	1	AS 122 Air Science I	1
**Physical Education	1	Physical Education	1
	17		17

SOPHOMORE YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
MA 211 Calculus	3	MA 212 Calculus	3
PY 211 Physics	4	PY 212 Physics	4
TX 281 Fiber Quality	4	CH 223 Organic Chemistry	4
CH 221 Organic Chemistry	4	HI 252 U. S. History	3
**MS 201 Military Science II or		***English Elective	3
**AS 221 Air Science II	1	MS 202 Military Science II or	
**Physical Education	1	AS 222 Air Science II	1
	17	Physical Education	1
			19

JUNIOR YEAR

Fall Semester	*Credits*
TC 303 Textile Chemistry III	3
ST 361 Intro. to Statistics	3
CH 215 Quantitative Analysis	4
***English Elective	3
Humanity or Economics	3
Free Elective	3
	19

Spring Semester	*Credits*
TC 304 Textile Chemistry	3
TC 412 Textile Chem. Analysis	3
TX 327 Textile Testing	4
PS 201 American Government	3
Humanity or Economics	3
Free Elective	3
	19

SENIOR YEAR

Fall Semester	*Credits*
TC 403 Tex. Chem. Tech.	3
TC 405 Tex. Chem. Tech. Lab.	2
TC 511 Chemistry of Fibers	3
TX 581 Instrumentation	3
Free Elective	3
CH 431 Physical Chemistry (1)	3
or	
Stem Hours (See Below) (2)	3
	17

Spring Semester	*Credits*
TC 404 Tex. Chem. Tech.	3
TC 406 Tex. Chem. Tech. Lab.	2
TC 501 Seminar in Textile Chemistry	2
****Humanity or Social Science	3
Free Elective	3
CH 433 Physical Chemistry (1)	3
or	
Stem Hours (See Below) (2)	4
	16 or 17

(1) Only for students electing chemistry option.

(2) Only for students electing technology option.

Credits Required—Freshman Year, 34; Sophomore Year, 36; Junior Year, 38; Senior Year, Physical Chemistry Option, 33; Total 141. Senior Year, Technology Option, 34; Total 142.

Stem Requirements

Stem 1. Quality Control	*Credits*
TX 521 Textile Testing II	3
TX 522 Textile Quality Control	3
Transfer to free electives	1
	7

Stem 2. Fabric Technology	*Credits*
TX 365 Fabric Technology	4
TX 575 Fabric Analytics and Characteristics	3
	7

Stem 3. Yarn Technology	*Credits*
TX 303 Fiber and Yarn Technology	4
TX 430 Continuous Filament Yarns	
or	
TX 436 Staple Fiber Processing	3
	7

Stem 4. General

Students electing this stem must take a three-course sequence totaling a minimum of nine semester hours. The sequence will generally be selected from courses in psychology, industrial engineering, or from the School of Liberal Arts. The sequence must be approved by the student's advisor.

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* Qualified entering students taking MA 102 who earn grade of "C" or better, receive credit for MA 111.

** Students excused from military or air science and/or physical education will schedule equivalent credits in courses from the following departments: Economics, English, History and Political Science, Modern Languages, Philosophy and Religion, Psychology, Rural Sociology, Social Studies, or Sociology.

*** If approved in advance, students who average "C" or above on composite, English 111, 112 may substitute 6 credits of modern languages.

**** Students electing Stem 4 may use these credits in conjunction with the stem hours to take a three-course sequence in psychology, industrial engineering, or economics.

TEXTILE TECHNOLOGY

Lineberger Professor ELLIOTT B. GROVER, *Head of the Department*

Burlington Professor D. S. HAMBY, *Graduate Administrator*

Professors:
J. F. BOGDAN, *Director, Basic Research;* J. A. PORTER, JR.

Associate Professors:
W. E. MOSER, J. E. PARDUE, W. C. STUCKEY, JR., R. E. WIGGINS

Research Associate Professor:
E. H. BRADFORD

Assistant Professors:
E. B. BERRY, J. W. KLIBBE, L. T. LASSITER

Research Assistant Professors:
B. S. GUPTA, E. E. HUTCHISON, JOACHIM GAYLER

Instructors:
FRANCES W. MASSEY, M. L. ROBINSON, JR.

Research Instructors:
BETTY A. CAGLE, J. A. KING, S. W. LEE, A. R. VERBECK

Research Associate:
W. K. LYNCH

Research Assistants:
P. L. GRADY, J. E. HISADA

The purpose of the Department of Textile Technology is to instruct students in the theory and fundamental concepts, at both the basic and advanced levels, of fiber properties and fiber processing into yarns and fabrics. This is accomplished through the systematic study of the engineering properties of both the materials being processed and of the equipment involved in manufacturing. In addition, the department is engaged in research, with the support for the basic areas of work coming from college funds, and applied research through the industrial and governmental sponsors of the work. Not only faculty, but graduate and, when practical, undergraduate students are encouraged to participate in the research programs.

CURRICULUM

The curriculum of the Department of Textile Technology, during the student's first two years, is concerned primarily with the physical sciences, humanities, and social sciences, together with the limited but very important basic studies in textile fundamentals. Following this phase of his work, the student in his junior and senior years does his major work in textiles, with a minimum of study outside of textiles.

The primary objective of the textile technology curriculum is to provide as general an education as possible and at the same time to prepare the graduate for profitable employment in the textile industry. This is accomplished through an integration of physical sciences and the application of the sciences and economics to the field of textiles.

In addition to the wide selection of basic sciences, the student also

has the opportunity for diversification within the School of Textiles. The curriculum offers depth in such selected areas as fiber and yarn technology, fabric technology, knitting technology, general textiles, and textile management.

THE FOUR-ONE PROGRAM

The School of Textiles has developed a program designed to permit the student with a B.S., A.B., or B.A. degree from an accredited college or university to complete the requirements for a B.S. degree in textile technology after the satisfactory completion of one year of study.

The minimum entrance requirement into this program is a baccalaureate degree from an accredited educational institution. The undergraduate program should contain at least 25 percent of the credit hours in the fields of basic and physical sciences. The undergraduate program of each applicant is considered individually; however, in general, a complete transfer of credits is usually possible.

The normal program at the School of Textiles is designed for students who have had a sufficient amount of the basic and physical sciences, humanities and social sciences. Presuming that these conditions are met, the student can complete the degree requirements in two regular semesters and summer school. It is quite possible that students not meeting the minimum requirements in the sciences or applied mathematics could remove these deficiencies in the summer session prior to the fall semester, which would mean that completion of studies would be achieved at the end of the normal period.

GRADUATE STUDIES

The Department of Textile Technology offers two graduate programs—one leading to a degree of Master of Science and the second leading to the degree of Master of Textile Technology.

The objectives of the Master of Science are to develop in students their abilities to initiate and conduct independently investigations which lead to the development of new knowledge, and to stimulate the thought processes associated with learning and decision making. It is endeavored to accomplish this through a program designed to increase the knowledge of the student, and by enabling him to develop a more comprehensive understanding of the various fields through study and research.

The Master of Textile Technology degree is offered for students who are interested in the more advanced applications of fundamental principles to the field of textile technology rather than in training which would fit them for careers in research. A strong supporting second field of interest is encouraged, such as experimental statistics, industrial engineering, textile chemistry, physics, or one of many others that may be compatible.

A number of graduate assistantships are available to students who qualify for either program. For those students interested in details

concerning the graduate programs, reference should be made to the catalog of the Graduate School.

FACILITIES

The facilities of the Department of Textile Technology are subdivided into separate laboratory areas for processing of cotton and other short staple fibers; woolen, worsted and long staple synthetic fibers; throwing of continuous filament yarns; warp preparation and slashing; cam, dobby, and jacquard weaving; physical testing; applied research laboratories; and a data processing laboratory.

Cotton and Short Staple Synthetics

This area is complete in respect to modern opening, picking, carding, combing, drawing, roving, spinning, winding, and twisting equipment. The laboratory facilities are kept up-to-date which enables the school to maintain one of the most complete and modern facilities of this type in the world.

Woolen, Worsted, and Long-Staple Synthetic Fibers

A laboratory is set up for the processing of wool and long-staple synthetic fibers and blends. Included in the equipment is a Davis and Furber Wool Unit, complete from machinery to handle blending through spinning. Another set of machinery in this laboratory is designed to process the longer staple natural and synthetic fibers on the American worsted and new fiber systems. Tow-to-top machines, rectilinear combs, intersecting gills, wide ratch roving and spinning frames, and other supplemental equipment permit the processing of these fibers in many commercially oriented paths into spun yarns.

Continuous Filament Yarns

The continuous filament laboratory has the complete range of equipment necessary for the processing of thrown yarn and includes: soaking tub, extractor, dryer, twist-setting oven, spooler, upstroke twisters, doubler twister, quill winder, cone winders, and nylon sizing machine, plus supplementary equipment such as a texturizing machine.

Warp Preparation and Slashing

The equipment for preparing yarn for weaving includes high speed warper and a rayon-type slasher with auxiliary equipment. There is also a silk-type combination warper and beamer used for making short warps for student instruction. There is a separate room for drawing in warps.

Cam, Dobby, and Jacquard Weaving

The weaving facilities are subdivided into three laboratories: cam, jacquard, and dobby weaving; with this equipment, instruction is given in how to produce such fabrics as print cloths, denims, sateens, ginghams, fancy shirting, dobby weave dressing and drapery mate-

rials, pile, leno and jacquard fabrics, woven from natural and synthetic fibers. All weave rooms are completely humidified.

Physical Testing

There are three separate air-conditioned laboratories, two of which are used for teaching and undergraduate student work and another for industrial research and graduate student research.

The laboratories are equipped with a wide range of modern testing instruments designed to investigate and determine levels of quality for fibers, yarns, and fabrics. Included are microscopic equipment and dark room facilities.

Applied Research Laboratories

Four separate laboratories for applied research in fiber processing and weaving are located in this department. One of these laboratories has air-conditioning equipment designed so as to provide atmospheric conditions over a wide scale of controllable temperatures and humidities. These laboratories are completely equipped and designed for research by students and faculty in the areas of fiber processing and weaving. Another laboratory devoted to the development of electronic equipment and measuring systems is located in this department.

Data Processing Laboratory

This laboratory contains modern data processing equipment used in both the educational and research programs in the department. This facility is also being used extensively to study industry problems associated with quality, operations research, linear programming and similar activities.

TEXTILE TECHNOLOGY CURRICULUM

(Fiber and Yarn Technology, Fabric Technology, General Textiles, and Knitting Technology Stems)

FRESHMAN YEAR

Fall Semester	*Credits*	*Spring Semester*	*Credits*
TX 221 Fundamentals of Textiles	4	TX 261 Fabric Structure	4
CH 101 General Inorganic Chemistry	4	CH 103 General Inorganic Chemistry	4
*MA 111 Algebra and Trigonometry	4	*MA 112 Anal. Geom. and Calculus A	4
ENG 111 Composition and Rhetoric	3	ENG 112 Composition and Reading	3
*°MS 101 Military Science I		*°MS 102 Military Science I	
or		or	
°*AS 121 Air Science I	1	**AS 122 Air Science I	1
**Physical Education	1	°*Physical Education	1
	17		17

SOPHOMORE YEAR

Fall Semester	*Credits*
PY 211 General Physics	4
and	
MA 211 Calculus	3
or	
PY 211 General Physics	4
and	
Electives from Schedule A	3
TX 281 Fiber Quality	4
***English	3
HI 252 U. S. History Since 1865	3
**MS 201 Military Science II	
or	
**AS 221 Air Science II	1
**Physical Education	1
	19

Spring Semester	*Credits*
PY 212 General Physics	4
and	
MA 212 Calculus	3
or	
PY 212 General Physics	4
and	
Electives from Schedule A	3
TC 201 Textile Chemistry I	2
Humanities or Economics	3
PS 201 American Governmental System	3
**MS 202 Military Science II	
or	
**AS 222 Air Science II	1
**Physical Education	1
	17

JUNIOR YEAR

Fall Semester	*Credits*
TX 303 Fiber and Yarn Tech.	4
TX 365 Fabric Tech.	4
ST 361 Introduction to Statistics	3
***English	3
Free Elective	3
	17

Spring Semester	*Credits*
TX 327 Textile Testing	4
TX 342 Knitting Principles	2
Stem Hours	8
Free Elective	3
	17

SENIOR YEAR

Fall Semester	*Credits*
TX 442 Knitted Fabrics	3
TX 581 Instrumentation and Control	3
TC 307 Textile Chemistry II	4
Stem Hours	3
Humanities	3
Free Elective	3
	19

Spring Semester	*Credits*
TX 485 Mill Design and Org.	4
Stem Hours	6
Social Sciences	3
Free Elective	3
	16

Credits required—freshman year, 34; sophomore year, 36; junior year, 34; senior year, 35; total hours, 139.

STEM REQUIREMENTS

(Fiber and Yarn Technology, Fabric Technology, General Textiles, and Knitting Technology Stems)

Stems 1 and 2 require the MA 211, 212 sequence.

Stem 1 Fiber and Yarn Tech.	*Credits*
TX 304 Fiber and Yarn Tech.	4
TX 430 Continuous Filament Yarns	3
TX 436 Staple Fiber Processing	3
and	
(TX 366 Fabric Tech.	4
(TX 483 Textile Cost Methods	3
or	
(Selection from Schedule B	6, 7, or 8****
	17 (to 19)

Stem 2 Fabric Tech.	*Credits*
TX 366 Fabric Tech.	4
TX 478 Design and Weaving	3
TX 575 Fab. Anal. and Char.	3
and	
(TX 304 Fiber and Yarn Tech.	4
(TX 483 Textile Cost Methods	3
or	
(Selection from Schedule B	6, 7, or 8****
	17 (to 19)

Stems 3 and 4 do not require MA 211, 212 sequence.

Stem 3 General Textiles	*Credits*
TX 304 Fiber and Yarn Tech.	4
TX 366 Fabric Tech.	4
TX 483 Textile Cost Methods	3
Electives from Schedule C	6
	17

*Stem 4***** *Knitting Tech.*	*Credits*
TX 430 Continuous Filament Yarns	3
TX 441 Flat Knitting	3
TX 444 Garment Mfgr.	3
TX 447, 448 Adv. Knitting Lab.	4
TX 483 Textile Cost Methods	3
Transfer to Free Elective	1
	17

* Qualified entering students taking MA 102 who earn grade of "C" or better receive credit for MA 111.

** Students excused from military or air science and/or physical education will schedule equivalent credits in courses from the following departments: Economics, English, History and Political Science, Modern Languages, Philosophy and Religion, Psychology, Rural Sociology, Social Studies, and Sociology.

*** If approved in advance, students who average "C" or above on composition, English 111, 112, may substitute 6 credits of modern languages.

**** Any hours above the six allocated may be taken from free electives.

***** Either Mathematics-Physics sequence is acceptable.

SCHEDULE A

Schedule A is comprised of a two-course sequence totaling six semester hours. The sequence elected by the student must meet with the approval of his advisor. Illustrative of the sequences would be studies in the areas of industrial engineering, industrial psychology, economics, or other approved fields of study.

SCHEDULE B

Schedule B is comprised of a two-course sequence totaling in each case a minimum of six credit hours. The sequence elected by the student must meet with the approval of his advisor. Illustrative of the sequences would be studies in the areas of mechanics and strength of materials, advanced statistics, advanced physics, industrial engineering, textile quality control, and other approved courses of the 300 level or above.

SCHEDULE C

Schedule C is comprised of a two-course sequence in the field of textiles totaling in each case a minimum of six credit hours. Illustrative of the sequences available are the following:

Continuous Filament Yarns ....TX 430 (3)
and Staple Fiber Processing ...TX 436 (3)

Design and Weaving .....TX 478 (3)
and Fab. Anal. & Char. .....TX 575 (3)

Textile Testing II .....TX 521 (3)
and Tex. Quality Control .....TX 522 (3)

FOUR-ONE BACHELOR OF SCIENCE CURRICULUM IN TEXTILE TECHNOLOGY FOR APPROVED COLLEGE GRADUATES

Fall Semester	*Credits*
TX 221 Fund. of Textiles	4
TX 261 Fabric Structure	4
TX 281 Fiber Quality	4
TX 303 Fiber and Yarn Tech.	4
ST 361 Intro. to Statistics*	3
	19

Spring Semester	*Credits*
TX 304 Fiber and Yarn Tech.	4
TX 327 Textile Testing	4
TX 365 Fabric Technology	4
TX 430 Continuous Filament Yarns	3
TX 485 Mill Design and Org.	4
	19

SUMMER SEMESTER

First Session	*Credits*
TX 436 Staple Fiber Processing	3
TC 307 Textile Chemistry II	4
	7

Second Session	*Credits*
TX 342 Knitting Principles	2
TX 366 Fabric Tech.	4
	6

Students completing this program may continue to the graduate level if scholastic average is suitable.

* If appropriate background has been received in statistics, a substitution may be made for this course.

TEXTILE TECHNOLOGY CURRICULUM (ECONOMICS OPTION)

FRESHMAN YEAR

Same as Textile Technology.

SOPHOMORE YEAR

Fall Semester	*Credits*
PY 211 General Physics	4
MA 211 Calculus	3
TX 281 Fiber Quality	4
HI 252 U. S. History Since 1865	3
EC 201 Economic Principles	3
**MS 201 Military Science II	
or	
**AS 221 Air Science II	1
**Physical Education	1
	19

Spring Semester	*Credits*
PY 212 General Physics	4
MA 212 Calculus	3
TC 201 Textile Chemistry I	2
PS 201 American Governmental System	3
EC 202 Economic Principles	3
**MS 202 Military Science II	
or	
**AS 222 Air Science II	1
**Physical Education	1
	17

JUNIOR YEAR

Fall Semester	*Credits*
TX 303 Fiber and Yarn Tech.	4
ENG 211 Business Communications	3
ST 361 Intro. to Statistics	3
EC 312 Accounting for Engrs.	3
Stem Hours	3
Free Elective	3
	19

Spring Semester	*Credits*
TX 327 Textile Testing	4
TX 365 Fabric Tech.	4
TC 307 Textile Chemistry II	4
EC 411 Marketing Methods	3
Free Elective	3
	18

SENIOR YEAR

Fall Semester	*Credits*
TX 342 Knitting Principles	2
TX 483 Textile Cost Methods	3
TX 501 Textile Tech. Seminar	2
TX 575 Fab. Anal. and Char.	3
ENG 231 Basic Speaking Skills	3
Stem Hours	3
Free Elective	3
	19

Spring Semester	*Credits*
TX 485 Mill Design and Org.	4
EC 425 Industrial Management	3
Textile Elective***	3
Stem Hours	3
Free Elective	3
	16

Credits required—freshman year, 34; sophomore year, 36; junior year, 37; senior year, 35; total hours, 142.

ADDITIONAL STEM REQUIREMENTS

Group A	*Credits*
EC 310 Economics of the Firm	3
EC 407 Business Law	3
EC 409 Intro. to Production Costs	3
	9

Group B	*Credits*
EC 446 Economic Forecasting	3
EC 448 International Econ.	3
EC 490 Senior Seminar in Econ.	3
	9

Group C	*Credits*
EC 301 Production Prices	3
EC 409 Intro. to Production Costs	3
EC 420 Corporation Finance	3
	9

* Qualified entering students taking MA 102 who earn grade of "C" or better receive credit for MA 111.

** Students excused from military or air science and/or physical education will schedule equivalent credits in courses from the following departments: Economics, English, History and Political Science, Modern Languages, Philosophy and Religion, Psychology, Rural Sociology, Social Studies, and Sociology.

*** To be selected from TX 304, TX 366, or TX 444.

TEXTILE RESEARCH

ROBERT W. WORK, *Director of Research*

Although research projects associated with the granting of advanced degrees constitute a vital part of the educational program, they form only a segment of the total research activities carried on in the School. In keeping with similar trends in American universities, an increasing volume of research is done. This is supported by the state and federal governments or is sponsored by private industry. Such research covers a wide gamut of textile activities and ranges from the basic areas to the somewhat more applied. Thus, an atmosphere of scientific study and research endeavor permeates and is integral with the educational functions of the School.

TEXTILE MACHINE DEVELOPMENT

C. M. Asbill, Jr., *Head*

The Department of Textile Machine Development was established to assist the textile industry and the students of the School of Textiles in matters relating to textile processing machinery and testing apparatus.

Specifically the objective of the department is to make available to the textile industry and to the faculty and students of the School of Textiles the facilities of a qualified textile engineering department with means for the design, construction and testing of new or improved equipment.

The department attempts to keep informed as to modern machinery and practices by maintaining close contact with textile mills and machine manufacturers as well as by a digest of technical articles and patents, and by participation in technical and scientific conferences.

The physical facilities of the department include a completely equipped machine shop and electronics section, together with thoroughly trained operating personnel.

TEXTILE PLACEMENT BUREAU

Professor George H. Dunlap, *Director*

The Placement Bureau is a clearing house for students in the graduating class and for textile alumni. It is a coordinating agency for the employer and the graduates of the School of Textiles. The Placement Bureau tries to keep an accurate file of all textile alumni and the progress they have made. Therefore, all alumni are requested to notify the director when they receive a promotion or transfer from one organization to another.

TEXTILES LIBRARY

Adriana P. Orr, *Librarian*

The present School of Textiles Library was originally organized in Nelson Building in 1944 as a branch of the D. H. Hill Library. In 1951, as a result of a substantial gift by Burlington Mills Foundation, the library was relocated in the west wing of the building, and in 1964 an expansion is underway which will double the original space allocated for the library collection. This expansion has again been made possible through the generosity of Burlington Industries, Inc.

Attractive furnishings and air-conditioning create an area conducive to study and research. The library has been designed to provide indi-

vidual study carrels, a reading lounge, a reference/bibliography alcove, a library seminar room, and shelving and storage for the ever-growing collection of textile books, journals, machinery literature, patents and pamphlets. Typing facilities for students and photocopy services for users of the collection are available.

In addition to the traditional card catalog, supplementary card indexes have been prepared to analyze the collection in greater depth. The library also subscribes to various commercial indexing/abstracting services including *Chemical Abstracts, Textile Technology Digest,* and the Shirley Institute's *Summary of Current Literature.*

The library lends items to students, faculty and research staff of the institution, and will also lend to textile industry personnel. Interlibrary loan services are available to other institutions, and literature searching within reasonable limits is performed for qualified persons.

MILITARY TRAINING

DEPARTMENT OF MILITARY SCIENCE

Professor of Military Science COLONEL LEM M. KELLY

Assistant Professors of Military Science:
LT. COL. DAVID J. COLEMAN, JR., LT. COL. ROBERT S. DICKSON, III, MAJ. JOE E. LAND, JR., MAJ. JAMES E. LAWSON, MAJ. WOODROW O. WILSON, CAPT. ROBERT F. CARR, CAPT. NORMAN G. ERIKSEN, CAPT. ALBERT L. NORTON, CAPT. JOHN A. RATLIFF

DEPARTMENT OF AEROSPACE STUDIES

Professor of Aerospace Studies: COLONEL JAMES D. HOWDER

Assistant Professors of Aerospace Studies:
MAJ. HENRY G. BARTELS, MAJ. ROBERT J. SHELDON, MAJ. GERALD D. MALPASS, MAJ. VIRGIL S. CLARK, CAPT. JOHN F. SWATEK, CAPT. LARRY E. PLASTER, CAPT. ROBERT A. ROBINSON, CAPT. BENNETTE E. WHISENANT

OBJECTIVES

The Reserve Officers' Training Corps designates those students enrolled for training in the Department of Military Science or in the Department of Aerospace Studies. These departments are integral but separate academic and administrative subdivisions of the institution. The senior Army officer and the senior Air Force officer assigned to the University are designated as Professor of Military Science (PMS) and Professor of Aerospace Studies (PAS). These senior officers are responsible to the Secretary of the Army, the Secretary of the Air Force, and the Chancellor of the University for conducting their training and academic programs in accordance with instructions issued by the respective secretaries and as required by University regulations. Army officers who are assigned to the University as instructors in ROTC are called Assistant Professor of Military Science; Air Force officers, Assistant Professors

of Aerospace Studies. Non-commissioned officers of the Army are assigned as assistant instructors and administrative personnel. Non-commissioned officers of the Air Force are assigned as administrative and supply personnel.

The mission of the Army ROTC is to produce junior officers who by their education, training, and inherent qualities are suitable for continued development as officers in the United States Army.

The mission of the Air Force Officer Education Program (ROTC) is to produce officers of appropriate quality to satisfy stated Air Force officer requirements.

COURSE OF INSTRUCTION

The program of instruction for the Army ROTC consists of a two year basic course and a two year advanced course; the Air Force Officer Education Program consists of a two year General Military Education Course or a Field Training Course and a Professional Officer Education Course.

The University provides, in cooperation with the Air Force and the Army, a flight instruction program. A limited number of highly qualified cadets from both ROTC units participate in this instruction which includes approximately 36½ hours of flying in light aircraft plus ground school. Successful completion of this phase of the ROTC course will insure continued participation in military flying training probrams and may qualify cadets for a Federal Aviation Agency private pilot's certificate.

Satisfactory completion of the advanced courses qualifies a student for commissioning as a second lieutenant in the Army or Air Force Reserve upon graduation from the University A detailed description of all military courses is given under each of the departments in the section of the catalog which lists course descriptions.

MILITARY SCIENCE

The satisfactory completion of the first year of the Army ROTC course is a prerequisite for entering the second year. Enrollment in advanced courses is elective on the part of the student. The selection of advanced course students is made from applicants who are physically qualified and who have above average academic and military records. Veterans who have one year or more of service in the Armed Forces are eligible for enrollment in the Army ROTC advanced course upon reaching their junior year, provided they are in good academic standing, physically qualified, have not reached their 27th birthday, and are selected by the PMS and the Chancellor.

The Army ROTC course includes instruction in American military history, map reading, leadership, military teaching methods, military administration, operations, and logistics. These subjects not only prepare students to be officers in the United States Army, but also awaken in them an appreciation of the obligations of citizenship and secure for them personal benefits resulting from prac-

tical application of organization and responsible leadership. An elective subject is chosen from general academic areas in effective communication, science comprehension, general psychology, or political development and political institutions for utilization in the junior and senior years.

AEROSPACE STUDIES

A student enrolled in Air Force Officer Education Program (ROTC) may pursue a four year financial assistance, four year contract or two year Professional Officer Education program.

Students, to meet enrollment requirements, must be physically qualified and have above average academic records. Qualified veterans desiring a commission through Air Force Officer Education Program (ROTC) will be required to complete Aerospace Studies 250 and the Professional Officer Education Program. Non-veterans must have completed their degree requirements and either the four year Officer Education Program (ROTC) or Aerospace Studies 250 and the two year Officer Education Program prior to their 28th birthday to qualify for commission.

The Air Force Officer Education Program (ROTC) is designed to provide a professional education for the high quality young man who is interested in an Air Force career and prepare him for his obligations of citizenship to his country.

UNIFORMS

Officer-type uniforms for students of Army and Air Force ROTC are provided by the Federal Government.

CREDIT

Credit is allowed for work at other institutions having an ROTC unit established in accordance with the provisions of the National Defense Act and regulations governing the ROTC. Record of a student's prior training in the ROTC is obtained from the institution concerned.

FINANCIAL AID

Beginning in September 1965, there will be a four-year scholarship program for a limited number of selected students, paying $50.00 per month for ten months each year plus tuition, fees, books. In addition there will be a four year contract program and a two year advanced program; in these two programs, students in the last two years will receive a retainer fee of $40.00 per month for ten months each year. For summer training of 4 to 8 weeks students will receive cadet pay (same as Military or Air Force Academy cadets) and travel pay of 6 cents per mile. Students in the basic or general courses receive no monetary allowance.

ORGANIZATION OF THE ROTC

ARMY

The Army ROTC unit at North Carolina State consists of an

Army brigade, commanded by a cadet colonel, and comprising a support battalion and four numbered battalions. The cadet colonel and all other cadet officers are selected from students enrolled in the second year advanced course. Cadet sergeant majors, first sergeants, and sergeants first class are appointed from students enrolled in the first year advanced course. Certain specially selected students in the second year basic course also are appointed as cadet non-commissioned officers. Cadet officers and non-commissioned officers obtain invaluable experience in leadership by being responsible for conducting all drill instruction. They are observed and supervised in this by the officers and non-commissioned officers of the Army assigned to the University.

AIR FORCE

The Air Force ROTC unit is organized as a cadet wing (commanded by a cadet colonel) with an appropriate number of groups and squadrons; the squadrons are composed of flights and squads. The wing, group, squadron, and flight commanders and their staff are cadet commissioned officers and are selected from cadets enrolled in the advanced course. All other positions are held by cadet non-commissioned officers who are selected from basic cadets. Cadet officers and non-commissioned officers obtain invaluable experience in leadership by being responsible for planning and conducting all drill instruction. They are observed and supervised by the officers and airmen assigned to the University.

There is also an Army and Air Force Drum and Bugle Corps which is composed of cadets from each unit; the Corps performs at ceremonies and drills for the Brigade and the Wing and represents North Carolina State at selected public appearances.

DISTINGUISHED STUDENTS

The University is authorized to name outstanding students of the Army ROTC and Air Force ROTC as distinguished military students or distinguished AFROTC cadets. These students may, upon graduation, be designated distinguished military graduates or distinguished AFROTC graduates and may be selected for commissions in the regular Army and Air Force, provided they so desire.

THE GRADUATE SCHOOL

DONALD B. ANDERSON, *Vice President for Academic Affairs*, Chapel Hill
WALTER J. PETERSON, *Dean*, North Carolina State

The Graduate School of the Consolidated University of North Carolina is composed of three divisions, one at each of the three

units of the University. Each division is administered by a graduate dean and an administrative board representing the various degree-granting areas. The Vice President for Academic Affairs is the administrative officer of the Consolidated University who has responsibility for the development of policy in all graduate programs and for the coordination of the activities of the graduate schools at each of the three units of the University system.

MASTER'S DEGREES

At North Carolina State graduate instruction is offered in the fields of agriculture and life sciences, education, engineering, forestry, physical sciences and applied mathematics, and textiles. The Master of Science degree is offered in each of these areas. The Professional Master's degree, also offered in some of these fields, is intended for students who are interested in the more advanced applications of fundamental principles to specialized fields rather than in the acquisition of the broader background in advanced scientific studies which would fit them for careers in research.

DOCTOR OF PHILOSOPHY DEGREE

The Doctor of Philosophy degree is offered in the following fields: agricultural economics, agricultural engineering, animal science, applied mathematics, physics, bacteriology, botany (in the fields of physiology and ecology), ceramic engineering, chemical engineering, civil engineering, crop science, electrical engineering, entomology, experimental statistics, food science, forestry, genetics, mechanical engineering, nuclear engineering, physiology, plant pathology, rural sociology, soil science, and zoology (in the fields of ecology and wildlife biology).

Students interested in graduate study should consult the Graduate School Catalog which will be sent to them upon request. Inquiries should be addressed to: Dean of the Graduate School, North Carolina State, Raleigh, North Carolina.

GENERAL EXTENSION

EDWARD W. RUGGLES, *Director*

The Division of General Extension is a service arm of the University, offering to students and non-students alike, a multiplicity of correspondence courses, short courses, conferences, seminars and extension night classes.

CORRESPONDENCE COURSES

The division offers more than seventy-five different courses through its Bureau of Correspondence Instruction. Credit courses

are offered in the following subject areas: agriculture, architecture, economics, education, engineering, English, entomology, geology, history, mathematics, modern languages, philosophy, political science, psychology, rural sociology, sociology, and statistics.

The correspondence bureau also has available four high school review courses—English, algebra, solid geometry and plane geometry. These non-credit courses allow high school graduates to fulfill certain college entrance requirements. These courses are also of use to persons who have either scored poorly or need additional help on college entrance examinations.

EXTENSION NIGHT CLASSES

The division offers only non-credit night classes on-campus while credit courses are offered in many locales across the State.

The non-credit courses range in subjects from income tax, the stock market, art painting and traffic management. These courses, and many others, are offered throughout the year.

Credit courses are held in many sections of the State such as Kinston, Charlotte, Burlington, Greensboro on a demand basis. There must be sufficient interest and registrations for a course to be held. Other factors which enter in include the distance from the University, subject matter and the availability of instructors. A total of 157 classes were held in 14 locations during the past year.

SHORT COURSES AND CONFERENCES

The division offers a wide variety of short courses and conferences during the year. Courses will cover such general subject areas as agriculture, engineering, forestry, textiles, the physical sciences and education.

A listing of some of the courses and conferences which are sponsored by one of the University's academic departments include:

—Electrical Meter School, Pest Control Operators' School, Clay Plant Operators' Forum, Nurserymen's Short Course, Artificial Breeding Short Course, Cattlemen's, Dairymen's and Swine Conferences, Pesticide School, Flower Show Judges School, Farm and Small Business Income Tax, Sport Fishing Short Course, Cotton Classing, Warm Air Heating and Air Conditioning Short Course, Commercial Flower Growers Short Course and Nutrition Conference.

—Textile Wet Processing, Textile Executives Short Course, Knitting Short Course, Oil Burner Servicemen's School, North Carolina Press Association's Mechanical Conference, Short Course in Modern Farming, Egg Industry Conference, Industrial Engineers Seminar, State Highway Conference, Public Works Conference, Southern Industrial and Municipal Waste Conference, Roofing and Sheet Metal Forum, Southeastern Park and Recreation Institute, Industrial Ventilation Conference, Maintenance of Commercial Vehicles, Fire Alarm Superintendents Course.

—Critical Path Method (CPM), Radiation and Radiological Protection Course, Basic Aspects of Traffic Control, Dairy Herd Testers, Soil Fertility School, Food Sanitarians Course, Dairy Fieldmen and Sanitarians Short Course, Advanced Income Tax Course, Farm Press, Radio and TV Institute, Milkers Short Course and Photography Short Courses.

During 1963-64, there were 111 different courses and conferences sponsored by the University.

The North Carolina Truck Driver Training School (classified as a short course) annually offers twelve, four-week courses for professional truck drivers. The school is sponsored by the North Carolina Motor Carriers Association. A brochure with complete details is available.

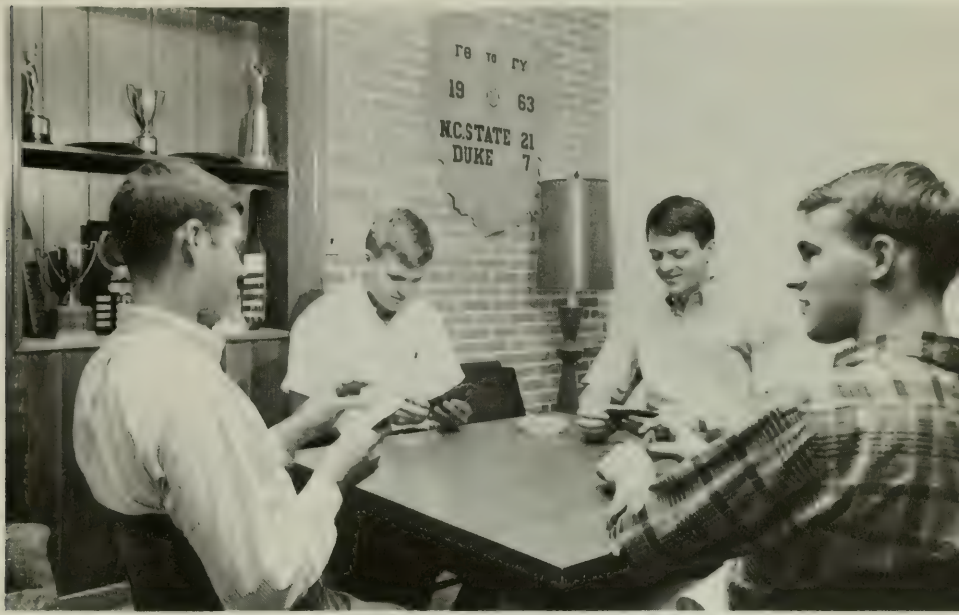
FURNITURE MANUFACTURING STUDENTS EXPLORE THE ENGINEERING ASPECTS OF GOOD DESIGN, PRODUCTION, MANAGEMENT AND MARKETING.

IN THE LABORATORY STUDENTS TEST THEORIES AND DEVELOP RESEARCH SKILLS BASIC TO THE INDUSTRIAL ARTS AND APPLIED SCIENCES.

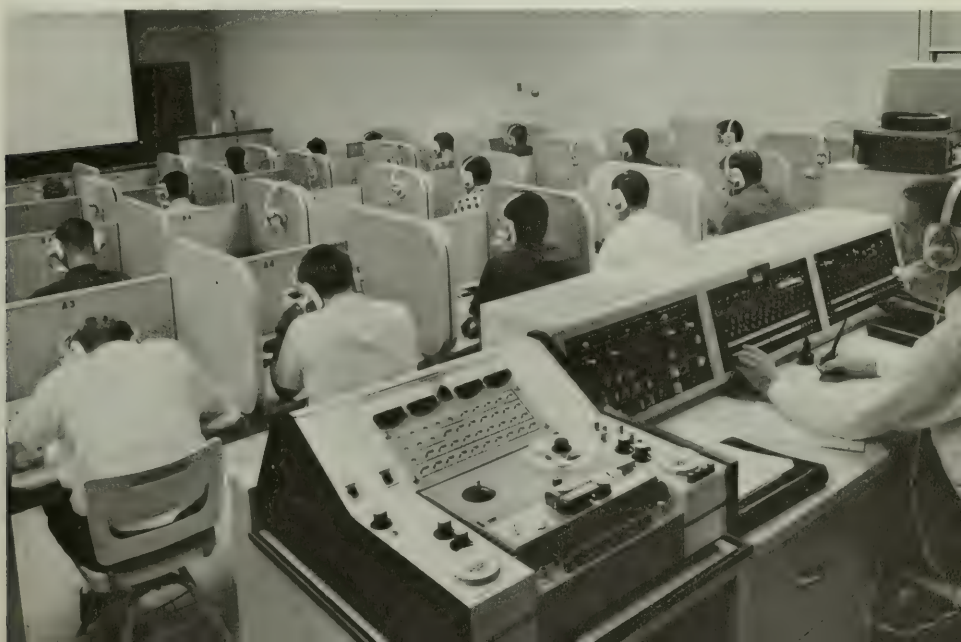
LIGHTS IN BROOKS HALL BURN LATE AS DESIGN STUDENTS APPLY THE TECHNIQUES AND KNOWLEDGE ESSENTIAL TO THE DESIGN PROFESSIONS DURING COUNTLESS HOURS AT THE DRAWING BOARD.

THE ENGINEERS' FAIR DRAWS AN INTERESTED AUDIENCE EACH YEAR WHEN STUDENTS EXPLAIN AND DEMONSTRATE VARIOUS ASPECTS OF ENGINEERING SKILLS AND KNOWLEDGE.

FRATERNITY MEMBERS TAKE A BREAK FROM STUDYING IN THE CARD ROOM OF ONE OF THE TWELVE HOUSES ALONG FRATERNITY ROW, ONE OF THE MOST RECENT ADDITIONS TO STATE STUDENT HOUSING.



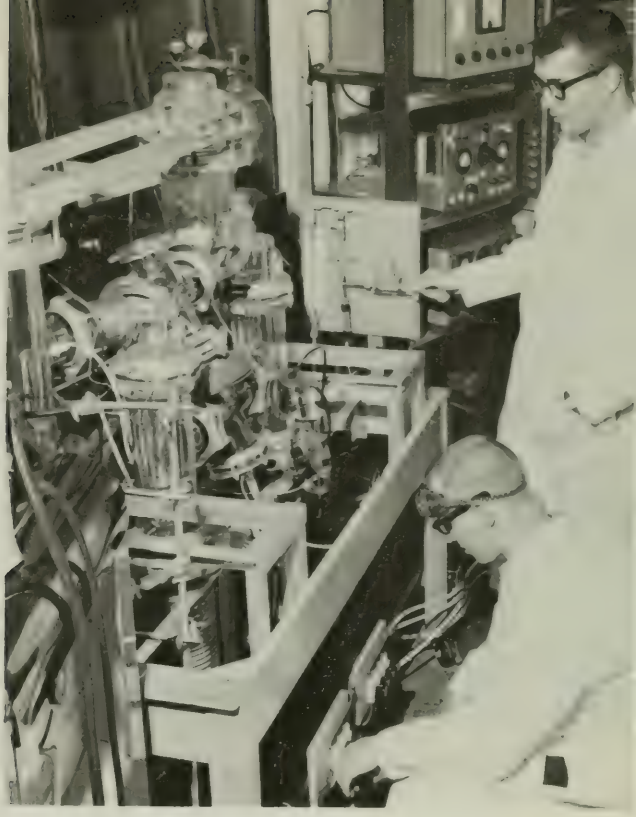
IN THE MODERN LANGUAGE LABORATORY AN ELECTRONIC TEACHING MACHINE ALLOWS THE INSTRUCTOR TO MONITOR EACH STUDENT AND GIVE HIM THE BENEFIT OF INDIVIDUAL ATTENTION.



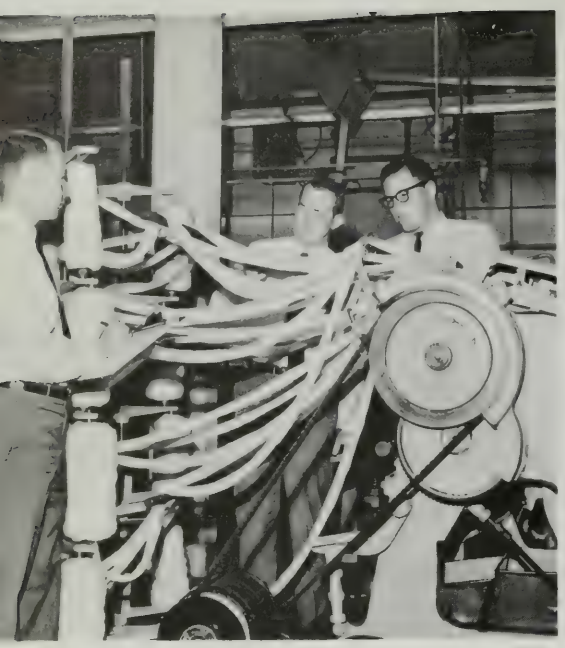
A SCHOOL OF AGRICULTURE PROFESSOR AND HIS RESEARCH ASSISTANT CHECK NORTH CAROLINA SOIL SAMPLES FOR ANALYSIS IN THE LABORATORY.

ONE OF THE MOST POPULAR STUDENT ACTIVITIES ON CAMPUS, MUSIC PLAYS AN IMPORTANT ROLE AT STATE. BANDS AND GLEE CLUBS PERFORM IN CONCERTS AND INFORMALLY THROUGHOUT THE YEAR.

STATE'S OUTSTANDING EDUCATIONAL AND RESEARCH PROGRAMS ARE STRENGTHENED BY MODERN, WELL-EQUIPPED LABORATORIES.



STUDENT ORGANIZED PROGRAMS OF THE ERDAHL-CLOYD UNION PROVIDE OPPORTUNITY FOR LEADERSHIP AND ADMINISTRATIVE EXPERIENCE. THE ART GALLERY FEATURES OUTSTANDING EXHIBITS ARRANGED BY A UNION COMMITTEE.



STUDENTS EXPLORE THE THEORY OF WOOL COMBING IN A WOOL PROCESSING LABORATORY, ONE OF THE MANY LABS FOR THE STUDY OF NATURAL AND SYNTHETIC FIBERS AVAILABLE FOR TEXTILE STUDENTS.

THROUGH CLASSROOM LECTURES THE EXPERIENCE OF THE PROFESSOR STIRS THE CURIOSITY OF THE STUDENT

PHYSICAL EDUCATION AND INTRAMURAL COMPETITION ARE BOTH IMPORTANT IN STATE'S ATHLETIC PROGRAM. CARMICHAEL GYMNASIUM PROVIDES OUTSTANDING ATHLETIC FACILITIES FOR TEAM AND INDIVIDUAL SPORTS.

STATE HAS THREE ATTRACTIVE CAFETERIAS AND SEVERAL CONVENIENT SNACK BARS SERVING STUDENTS AND STAFF.

COURSE DESCRIPTIONS

In a typical course description, the semester hours of credit, the number of actual lecture and laboratory hours of meeting per week, and the term or terms in which the course is offered are shown in this manner: 2(1-2) f s.

The 2 indicates the number of semester hours credit given for satisfactory completion of the course. The (1-2) indicates that the course meets for one hour (number on the left) of lecture and for two hours (number on the right) of laboratory work each week. The f s designation (fall semester and spring semester respectively) indicates that the course is offered in both fall and spring semesters.

AGRICULTURAL ECONOMICS

AGC 212 ECONOMICS OF AGRICULTURE 3 (3-0) f s

Prerequisite: MA 111

An introduction to the economic principles underlying agricultural production and marketing; organization for production in agriculture; consumers and their influence upon the demand for agricultural products; relationships between agriculture and other segments of the economy; dynamic factors in the economy which affect agriculture.

Messrs. Neuman, Peeler, Toussaint

AGC 303 ORGANIZATION AND BUSINESS MANAGEMENT OF FARMS 3 (2-2) f s

Prerequisite: AGC 212

An application of basic economic principles and techniques to the problems facing a farm business; use of budgeting, programming, systems analysis and other modern techniques to determine what, how, and how much to produce when faced with numerous alternatives; analysis of problems associated with farm size and the acquisition of adequate resources; use and analysis of farm records as an aid to better management. Two all-day Saturday field trips are required of all students.

Messrs. Ihnen, Hoover

AGC 311 ORGANIZATION AND BUSINESS MANAGEMENT OF MARKETING FIRMS 3 (2-2) f s

Prerequisite: AGC 212

A study of the agricultural marketing system and the current economic forces affecting its structure and efficiency; decision-making by agricultural business firms, with some discussion of integration and inter-firm relationships. Effects of monopoly in marketing relative to government policies of control. Classroom discussion is supplemented by visits to marketing firms and by practical problems illustrating firm decisions. A

laboratory period will be included in alternate weeks beginning with the second full week of classes. Students are expected to examine individually the marketing problems associated with the commodity of their choice.

Messrs. Chappell, Peeler

AGC 322 Organization and Management of Cooperatives 2 (2-0) s

Prerequisite: AGC 212

A study of the principles of cooperation applied to farmers' purchasing, marketing, and service cooperatives; the role of cooperatives in our society, and problems associated with organization, operation, and management. (Offered in Spring 1965 and alternate years.) Staff

COURSES FOR ADVANCED UNDERGRADUATES

AGC 413 Farm Appraisal and Finance 3 (2-3) s

Prerequisite: AGC 303

Examination of the source of the productivity and value of farm inputs; a critical analysis of, and practice in the use of, farm appraisal procedures currently used for land and buildings; review of the sources of, and repayment practices used in short and intermediate credit in agriculture; consideration of the forces operating in the whole economy with an examination of the implications of these changes for both the lender and borrower in agriculture.

Mr. Neuman

AGC 431 Agricultural Price Analysis 3 (3-0) f

Prerequisite: AGC 212

Principles of price formation; the role of prices in the determination of economic activity; the interaction of cash and future prices for agricultural commodities; methods of price analysis, construction of index numbers, analysis of time series data including the estimation of trend and seasonal variations in prices.

Mr. Schrimper

AGC 441 Agricultural Development in Foreign Countries 3 (3-0) s

Prerequisite: AGC 212 or EC 202 or EC 205

Identification of agricultural problems in underdeveloped countries; a review of economic criteria for analyzing the problems of developing agriculture and the techniques of analysis for solving such problems. Case studies of development programs in various countries will be discussed.

Staff

AGC 490 Seminar in Contemporary Economic Problems in Agriculture 1 (0-2) f

Prerequisite: Permission of instructor

Analysis of economic problems of current interest in agriculture. Credit for this course will involve a scientific appraisal of a selected problem and alternative solutions.

Mr. Bishop

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

AGC 512 Economic Analysis of Agricultural Factor Markets 3 (3-0) s

Prerequisite: AGC 212

This course is oriented to the relative significance of land, labor and capital as factors of production in a modern agricultural economy, including major changes in the respective roles of these factors of production in

recent years. An examination is made of the changes in characteristics of the supply and demand for these factors. The structure and efficiency of markets for these factors, including relevance of the institutional and attitudinal setting in each type of market, and nature of the demand-supply equilibrium will be investigated.
Public policies as they affect efficiency of the factor markets and other goals relating to the use of the basic factors of production in agriculture also will be considered.

Staff

AGC 521 Procurement, Processing and Distribution of Agricultural Products 3 (3-0) f

Prerequisite: AGC 311

A study of marketing firms as producers of marketing services and their role in the pricing process; the influence of government policies on the behavior of marketing firms; methods for increasing the efficiency of marketing agricultural products.

Mr. Simmons

AGC 523 Planning Farm and Area Adjustments 3 (2-2) s

Prerequisite: AGC 303

The application of economic principles in the solution of production problems on typical farms in the state; methods and techniques of economic analysis of the farm business; application of research findings to production decisions; development of area agricultural programs.

Mr. Pasour

AGC 533 Agricultural Policy 3 (3-0) s

Prerequisite: AGC 212

A review of the agricultural policy and action programs of the federal government in their economic and political setting; analysis of objectives, principal means, and observable results under short-term and long-term viewpoints, and under the criteria of resource use and income distribution within agriculture, and between agriculture and the rest of the economy; appraisal of alternative policy proposals; the effects of commodity support programs on domestic and foreign consumption, and some of the international aspects of United States agricultural policy; the attempts at world market regulations, and the role of international organizations, agreements, and programs.

Mr. Hoover

AGC 551 Agricultural Production Economics 3 (3-0) f

Prerequisite: AGC 212

An economic analysis of agricultural production including: production functions, cost functions, programming and decision-making principles; and the applications of these principles to farm and regional resources allocation, and to the distribution of income to and within agriculture.

Mr. Toussaint

AGC 552 Consumption, Distribution, and Prices in Agriculture 3 (3-0) s

Prerequisite: AGC 212

Basis for family decisions concerning consumption of goods and services and supply of productive factors; forces determining prices and income; interrelationships between economic decisions of the household and the firm.

Mr. West

AGC 592 Topical Problems in Agricultural Economics maximum 6

Prerequisite: Permission of instructor

An examination of current problems in the field of agricultural economics with emphasis on the use of theory to define and facilitate the consideration

of alternative solutions. The course content varies as changing conditions require the use of new techniques and new approaches to deal with emerging problems.

Staff

COURSES FOR GRADUATES

AGC 602 Monetary and Fiscal Policies in Relation to Agriculture 3 (3-0) s

Prerequisite: AGC 551

Aggregative theory relevant to monetary and fiscal policies; fundamentals of model building including essence of the Walrasian approach; mathematical models involving income, employment, price levels, money supply, interest rates and other aggregative variables; main economic magnitudes for the U. S. economy; the structure of taxes and government revenue; institutional determinants of monetary and fiscal operations in the U. S.; introduction to international monetary equilibrium and the relation of monetary-fiscal policies to agricultural incomes and prices.

Mr. Tolley

AGC 611 Agricultural Economic Analysis 3 (3-0) f

Prerequisites: AGC 551, MA 112

Determination of prices in a free enterprise economy and the role prices play in the allocation of resources; derivation of individual demand from the theory of consumer behavior and aggregation to market demand curves; relationship of the firm's production function and its assumed objective with cost curves for the firm; aggregation of cost curves into industry supply curves; determination of equilibrium prices and quantities.

Mr. Ihnen

AGC 612 International Trade in Relation to Agriculture 3 (3-0) s

Prerequisites or corequisites: AGC 602, AGC 641

Theories about international and interregional trade; determinants of trade between countries engaged in the import or export of agricultural products; policy issues related to trade.

Mr. Johnson

AGC 631 Economic and Social Foundations of Agricultural Policy 3 (3-0) f

Prerequisite: AGC 551

The study of logical and empirical problems of inquiry into public policies and programs that affect agriculture; analysis of policy-making processes, interdependencies among economic, political and social objectives and action; the study of forces which shape economic institutions and goals and of the logic, beliefs and values on which policies and programs that affect agriculture are founded.

Staff

AGC 632 Welfare Effects of Agricultural Policies and Programs 3 (3-0) s

Prerequisite: AGC 642

Description of the conditions defining optimal resource allocation; application of the conditions for maximum welfare in appraisal of economic policies and programs affecting resource allocation, income distribution, and economic development of agriculture.

Mr. Bishop

AGC 641 Economics of Production, Supply and Market Interdependency 3 (3-0) s

Prerequisites: AGC 611, MA 211

An advanced study in the logic of, and empirical inquiry into, producer behavior and choice among combinations of factors and kinds and quantities of output; aggregative consequences of individuals' and firms' decisions in terms of product supply and factor demand; factor markets and income distribution; general interdependency among economic variables.

Mr. Seagraves

AGC 642 Economics of Consumption, Demand and Market Interdependency 3 (3-0) f

Prerequisites: AGC 641, ST 513

An analysis of the behavior of individual households and of consumers in the aggregate with respect to consumption of agricultural products; the impact of these decisions on demand for agricultural resources; the competition among agricultural regions and for markets; and the interdependence between agriculture and other sectors of the economy.

Mr. Simmons

AGC 651 (ST 651) Econometric Methods I 3 (3-0) f

Prerequisites: ST 421, ST 502, AGC 611

The role and uses of statistical inference in agricultural economic research; the problem of spanning the gap from an economic model to its statistical counterpart; measurement problems and their solutions arising from the statistical model and the nature of the data; limitations and interpretation of results of economic measurement from statistical techniques.

Mr. Wallace

AGC 652 (ST 652) Econometric Methods II 3 (3-0) s

See ST 652.

AGC 671 Analysis of Economic Development in Agriculture 3 (3-0) f

Prerequisite: AGC 641

A theoretical and empirical study of the processes of economic growth; the problems of underdeveloped countries; the role of agriculture in a developing economy; an examination of policies and programs needed for effective economic development.

Mr. Maddox

AGC 699 Research in Agricultural Economics credits by arrangement

Prerequisite: Permission of graduate advisory committee

A consideration of research methods and procedures employed in the field of agricultural economics, including qualitative and quantitative analysis, inductive and deductive methods of research, selection of projects, planning, and execution of the research project.

Staff

AGRICULTURAL EDUCATION

COURSES FOR UNDERGRADUATES

ED 102 Objectives in Agricultural Education 1 (1-0) f s

Designed to help the student understand the purpose of Agricultural Education at N. C. State. Also provides an opportunity for students to

develop an understanding of purposes of vocational agriculture and other programs of education in agriculture.

Staff

ED 313 Teaching Rural People 2 (2-0) f s

The purpose of the course is to give the student an understanding of the basic principles involved in the teaching-learning process. The course will be built around problem experiences with principles of teaching and learning related to these experiences.

Staff

ED 411 Student Teaching in Agriculture 6 (3-12) f s

The first part of the semester (usually six or seven weeks) will be spent on campus. The remainder of the semester will be spent in a high school doing full-time student teaching. The student will get experience in all phases of the vocational agriculture program, including community study, adult education, home supervision. The student teacher will be supervised by the local teacher of agriculture and a member of the staff in Agricultural Education.

Staff

ED 412 Teaching Adults 2 (1-2) f s

Principles of effective teaching applied to adults. Experience in organizing and conducting groups for discussion of local problems. Staff

ED 413 Planning Educational Programs 2 (1-2) f s

Principles of program planning applied to educational programs in agriculture. Resources needed for adequate planning. Staff

ED 490 Senior Seminar 1 (1-0) f s

An analysis of the opportunities and problems facing educational leaders in agriculture with particular emphasis upon current problems.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 554 Planning Programs in Agricultural Education 3 (3-0) f s

Prerequisite: ED 411 or equivalent

Consideration of the need for planning programs in education; objectives and evaluation of community programs; use of advisory group; organization and use of facilities.

Messrs. Beam, Bryant

ED 568 Adult Education in Agriculture 3 (3-0) f s

Prerequisite: ED 411 or equivalent

Designed to meet the needs of leaders in adult education. Opportunity to study some of the basic problems and values in working with adult groups. Attention will be given to the problem of fitting the educational program for adults into the public school program and other educational programs as well as to methods of teaching adults.

Messrs. Beam, Scarborough

ED 593 Special Problems maximum 6

Prerequisite: ED 411 or equivalent

Opportunities for students to study current problems under the guidance of the staff. Staff

COURSES FOR GRADUATES ONLY

ED 617 Philosophy of Agricultural Education 3 (3-0) f s
Prerequisite: ED 554 or equivalent

An examination of current educational philosophies and their relation to educational practices. Study of leaders in the different fields of education.
Mr. Scarborough

ED 664 Supervision in Agricultural Education 3 (3-0) f s
Prerequisite: ED 563 or equivalent

Organization, administration, evaluation and possible improvement of present supervisory practice; theory, principles and techniques of effective supervision in agricultural education at different levels.

ED 693 Advanced Problems maximum 6 f s
Prerequisite: ED 593 or equivalent

Study in current and advanced problems in teaching; evaluation of procedures and consideration for improving.
Staff

ED 694 Seminar in Agricultural Education maximum 2

A critical review of current problems, articles, and books of interest to students of agricultural education.
Staff

ED 699 Research maximum 6
Prerequisites: Fifteen credits and permission of advisor

Individual research on a specific problem of concern to the student.

AGRICULTURAL ENGINEERING

COURSES FOR UNDERGRADUATES

AGE 211 Farm Machinery 4 (2-4) f s

The study of farm machinery which begins with the materials of construction as they are related to design, cost, fabrication process, tools and techniques involved in construction, repair and maintenance, machine performance, reliability, machine capabilities and limitations. The operation service and adjustment of the machine will be studied by an analysis of the requirements to do the job for which it was designed, and consideration of the conditions under which it must operate. The selection, management, and economics of owning and operating machinery is emphasized.
Mr. Howell

AGE 251 Tools and Materials 3 (2-3) f
Prerequisite: Enrollment in ASE curriculum

Tools and Materials is a course designed to acquaint Agricultural Engineering students with the various tool processes and materials related to tne agricultural industries. Emphasis is placed on the physical properties of materials as they must be considered in the design and construction of machinery, labor saving equipment, and building construction. Tool processes that the agricultural engineer encounters in the practice of the profession are discussed. Many of the more frequently used processes are demonstrated by the instructor and practiced by the student.
Mr. Blum

AGE 303 Energy Conversion for Agricultural Production 2 (2-0) f
Prerequisites: BS 100, MA 112 or MA 201, PY 211 or PY 205

Energy transformations and exchanges of plants and animals are studied

on the basis of physical theories and principles. Specific examples in thermal radiation, convection, conduction, phase changes, muscle work, photosynthesis, respiration, and concentration of solutions will be discussed.
Mr. Suggs

AGE 321 Irrigation, Terracing and Erosion Control 3 (2-3) s
Prerequisite: Junior standing
A study of the principles of soil and water conservation engineering. Topics discussed are: irrigation, surface and subsurface drainage, farm ponds, hydraulics of open channels, soil erosion, and the use of basic surveying equipment.
Staff

AGE 331 (FS 331) Food Engineering 3 (2-2) s
Prerequisite: AGE 341
A disciplined study of selected basic engineering principles applicable, wholly or in part, to processing and preservation. The course will include not only a study of the several forms of energy and how they may be altered in state, composition, direction or force to fulfill the various processing requirements, but also the latest means of energy conversion to affect efficient and practical applications of power, heat and refrigeration.
Mr. Weaver

AGE 332 Farm Structures 3 (2-3) f s
Prerequisite: PY 211 or PY 221
This course is designed to acquaint the student with the role of farm structures in a rapidly changing agricultural situation. This, in turn, requires study of environmental relationships, materials flow, structural features, design techniques, construction materials, and construction procedures. Emphasis is placed on relating the theory to practical applications encountered in problem situations. Mr. Blum

AGE 341 Farm Electrification and Utilities 3 (2-2) f
Corequisite: PY 212 or PY 221
Problems and general study in the proper selection and use of applicable farm electric equipment and allied utilities.

AGE 352 Control of Environment 2 (2-0) s
Prerequisite: ME 301
Equations for applying heat transfer and diffusion principles to specific problems are developed from thermodynamic principles and definitions. Analogies with other systems are made through mathematical similarity, particularly electrical systems. Psychrometric, heat transfer and mass transfer principles are used to indicate practical methods of environmental modification for biological materials in biological systems.
Mr. Jordan

AGE 361 Analytical Methods 3 (2-2) f
Prerequisite: MA 301
Corequisite: EM 301
A course designed to develop the student's skill in problem solving, ranging from the standard approaches to the mechanical design of machine elements and mechanisms to innovative approaches to the design of whole machines and systems. Mr. Bowen

AGE 411 Farm Power and Machinery 3 (2-3) f s
Prerequisites: AGE 211, PY 211 or PY 221
This course is designed to provide students in Agricultural Engineering

Technology with a knowledge of the operations of manufacturing and distribution organizations of farm machinery and their places in these organizations. Included is a practical course in farm tractors and engines with emphasis on familiarizing the student with component parts—their application, operation, and maintenance, as well as with the selection of these units from the standpoint of power, performance, and ratings.

Mr. Fore

AGE 433 Crop Preservation and Processing 3 (2-3) s

Prerequisite: PY 211

This course deals with the physical and biochemical characteristics of harvested crops and crop products, as they define the requirements for the best preservation of quality. The properties of air-water vapor mixtures, the application of heat to air and crops, the characteristics and use of fans and heaters, the air flow requirements and measurement for crop preservation and materials handling will be studied. Feed preparation, mixing and handling are included in the course. Mr. Weaver

AGE 453 Bioengineering Parameters 2 (2-0) f

Prerequisites: AGE 303, AGE 352, MA 301

Physical properties and response characteristics of plant materials are studied in their relationship to engineering analysis for production, harvesting and processing operations. Topics include germination, growth dynamics, physical properties for harvesting and materials handling, biological response criteria, environmental effects, theory of curing and drying, and quality evaluation. Mr. Johnson

AGE 461 Analysis of Agricultural Production Systems 3 (3-0) f

Prerequisites: MA 201, EC 205, ST 361

Survey of methods of systems analysis for agricultural engineering students. Intermediate economic analysis, with particular emphasis on farm machinery economics; materials-handling problems; activity network and scheduling problems; techniques of obtaining and processing systems data.

Mr. Link

AGE 462 Functional Design of Field Machines 3 (2-2) s

Prerequisites: AGE 361, ME 301, AGE 461, SSC 200

A study of the modern farm tractor and field machines. The emphasis of the course is on the translation of measurements of biological and physical factors of the agricultural production system into machine specifications that can be effectively converted into production machines by engineers of the manufacturing industry. Mr. Bowen

AGE 471 Soil and Water Conservation Engineering 3 (2-3) s

Prerequisites: CE 201, SSC 200, ST 361

General aspects of agricultural hydrology, including precipitation, classification of climate, rainfall disposition, methods of estimating runoff, fundamental soil and water relationships, and hydraulics of flow in open channels and closed conduits, will be given. Included also are factors affecting erosion, methods of controlling erosion, land use classification, drainage, land clearing, irrigation methods, design requirements for portable irrigation systems, and economic aspects of irrigation in the Southwest.

Mr. Wiser

AGE 481 Design of Farmstead Engineering Systems 3 (2-3) s

Prerequisites: AGE 453, AGE 461, AGE 491

Application of conditioning principles to provide the required environment for optimum agricultural production is stressed. Environmental requirements imposed by the biological materials in farmstead systems are related to the first principles of physiology. Consideration of labor reduction and

replacement of human decisions with control mechanisms are formalized. Environmental requirements, proper arrangement, material flow, equipment selection and control, and estimation of external loads are presented to indicate design procedures for a sound, functional building.

Mr. Jordan

AGE 491 Electrotechnology for Agricultural Production 3 (2-3) f

Prerequisites: EE 331, EE 332

Principles of operation of sensors and transducers and their use in measuring environmental and physical variables. Typical circuits will be used to illustrate how sensing devices are employed, to illustrate the use of circuit analysis techniques, and to study the operational characteristics. Control circuits with applications of transent analysis for environment control and switching circuits for materials handling systems. Revelant power distribution techniques, wiring codes, and power machinery will be studied in relation to agricultural production problems. Mr. McClure

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

AGE 552 Instrumentation for Agricultural Research and Processing 2 (1-3) f

Prerequisites: EE 331, MA 301

Theory and application of primary sensing elements and transducers. Calibration and use of standards. Use of electronic and solid state circuits in amplifiers, recorders and controllers. Special circuits for agricultural processing. Mr. Splinter

AGE 590 Special Problems credits by arrangement

Prerequisite: Senior or graduate standing

Each student will select a subject on which he will do research and write a technical report on his results. He may choose a subject pertaining to his particular interest in any area of study in Agricultural Engineering.

Staff

COURSES FOR GRADUATES ONLY

AGE 654 Agricultural Process Engineering 3 (3-0) s

Prerequisite: MA 441

Generalized classical thermodynamics is extended by Onsager's relations to provide a theoretical basis for analyzing the energetics of systems that include life processes. Mr. Johnson

AGE 661 Analysis of Function and Design of Farm Machinery 3 (2-3) s

Prerequisite: PY 411

Studies of methods and equipment used in determining the functional requirements of machine components and the writing of machine specifications in terms of fundamental parameters. A study of the principles of descriminate and indescriminate mechanical selection of agricultural products with emphasis on the theory of servo-systems. Mr. Bowen
(Offered 1964-65 and alternate years.)

AGE 671 Theory of Drainage, Irrigation and Erosion Control 4 (3-3) s

Prerequisite: MA 513

Emphasis is placed on the physical and mathematical aspects of problems in conservation engineering and an attempt is made to rationalize procedures which have often come about through experience rather than through analytical considerations. Examples are presented of cases where such an

analytical approach has already improved, or shows promise of improving, design criteria and procedures. Staff

(Offered 1963-64 and alternate years.)

AGE 681 Analysis of Function and Design of Farm Buildings 4 (4-0) f

Prerequisite: AGE 481

A study of the parameters in the design of a farmstead system with economic criteria pertaining to a formal design procedure. Mr. Jordan

AGE 695 Seminar 1 (1-0) f s

Prerequisite: Graduate standing in Agricultural Engineering

A maximum of two credits is allowed.

Elaboration of the subject areas, techniques and methods peculiar to professional interest through presentations of personal and published works; opportunity for students to present and defend, critically, ideas, concepts and inferences. Discussions to point up analytical solutions and analogies between problems in Agricultural Engineering and other technologies, and to present the relationship of Agricultural Engineering to the socioeconomic enterprise. Mr. Hassler

AGE 699 Research in Agricultural Engineering credits by arrangement

Prerequisite: Graduate standing in Agricultural Engineering

A maximum of six credits is allowed toward a master's degree; no limitation on credits for doctorate program.

Performance of a particular investigation of concern to Agricultural Engineering. The study will begin with the selection of a problem and culminate with the presentation of a thesis. Graduate Staff

AGRICULTURE AND LIFE SCIENCES

ALS 103 Orientation 1 (0-2) f

An introduction to the scope and objectives of a university education with particular emphasis on aspects related to agriculture and biology. Guest lecturers and laboratory demonstrations. Mr. Glazener

AC 311 Communications Methods and Media 3 (3-0) s

Prerequisites: ENG 111, ENG 112

Designed to give an insight into the communications process: written, oral and visual techniques of communications; a survey of the channels of communications available; principles and techniques for using these channels individually or combined into a publicity, promotion, public relations, information or advertising program. Mr. Carpenter

ALS 499 Honors Student Research 3 (0-3)

A research program open only to students in the Honors Program. A student may receive from one to three semester hours credit.

AEROSPACE STUDIES

GENERAL MILITARY EDUCATION

AS 121 Aerospace Studies 100 1 (0-1) f

An introductory course exploring the causes of the present world conflict, the role and relationship of military power to that conflict, and the responsibility of an Air Force Officer. The course begins with a discussion of the factors from which differing political philosophies have evolved. It continues with a tri-dimensional analysis of the three prime political philosophies which have guided segments of society in the twentieth century. This is followed by a discussion of the means that nations develop to pursue their objectives and how they confront each other in the use of these means.

AS 122 Aerospace Studies 100 1 (2-1) s

The course continues with the study of individual military systems, with emphasis upon the U.S. Department of Defense and the U.S. Air Force.

AS 221 Aerospace Studies 200 1 (2-1) f

Aerospace Studies 200 continues the study of world military forces and the political-military issues surrounding the existence of these forces. This includes a study of the United States Army, and the United States Navy, their doctrines, missions and employment concepts; a study of the military forces of NATO, CENTO, SEATO, and their role in free world security.

AS 222 Aerospace Studies 200 1 (0-1) s

Instruction deals with an investigation of the military forces of the USSR, the Soviet Satellite Armies, and the Chinese Communist Army. The course is concluded with an analysis of the trends and implications of world military power.

PROFESSIONAL OFFICER EDUCATION PROGRAM

AS 321 Aerospace Studies 300 1 (2-1) f

Prerequisite: Aerospace Studies AS 100 and AS 200, and/or Field Training Course (AS 250)

A survey course about the nature of war; development of airpower in the United States; mission and organization of the Defense Department; Air Force concepts, doctrine, and employment; astronautics and space operations; and the future development of aerospace power. Includes the United States space programs, vehicles, systems, and problems in space exploration.

AS 322 Aerospace Studies 300 2 (3-1) s

Study continues in depth concerning the role of space exploration and operations in maintaining general aerospace supremacy.

AS 421 Aerospace Studies 400 2 (3-1) f

Prerequisite: Aerospace Studies 300

A study of professionalism, leadership, and management. Includes the meaning of professionalism, professional responsibilities, the military jus-

tice system, leadership theory, functions, and practices, management principles and functions, problem solving, and management tools, practices and controls.

AS 422 Aerospace Studies 400 1 (2-1) s

Study continues with emphasis in developing communicative skills. Study is made of the Uniform Code of Military Justice and the managerial functions of the professional military officer are investigated in depth.

FIELD TRAINING COURSE

An integral part of the Officer Education Program (ROTC) is the Field Training Course (AS 250), a six week (four weeks prior to summer of 1966) encampment at an active Air Force Base. During the summer encampment a cadet is trained in the use of weapons, in close-order drill; he will participate in physical training, competitive sports, orientation flying and will become familiar with aerospace vehicles and emergency equipment; he will observe at first hand various organizations on the base in the performance of their everyday operations. A student enrolled in the Professional Education Program will attend a Field Training Course between his sophomore and junior years.

ANIMAL SCIENCE

COURSES FOR UNDERGRADUATES

ANS 201 Elements of Dairy Science 4 (3-3) f

Fundamental principles of milk production; breeds, selection, feeding and management of dairy cattle; composition, quality and food value of milk products; principles of processing and manufacturing dairy products.

Mr. Davenport

ANS 202 Fundamentals of Animal Husbandry 4 (3-3) f s

Principles of feeding, managing and marketing meat animals. Year to year and seasonal price trends and relationships. Relation of slaughter grades to carcass cut-out values. Mr. Wilder

ANS 302 Selecting Dairy and Meat Animals 2 (0-6) f

A study of dairy and meat animals including desired characteristics in breeding and market animals and relating to productive performance. Market classes and grades of beef cattle, sheep and swine and relation of live animal grade to carcass grade will be studied. Herd book study, pedigree evaluation and breed history and organization will be included.

Messrs. Gregory, Murley

ANS 303 (FS 303) Meat and Meat Products 3 (2-3) s

Prerequisite: CH 220

Study of live animal and carcass relationship, dressing percentages and cut-out values. Slaughtering, cutting, curing, freezing and handling of

meat and meat products for commercial and home use.
Messrs. Blumer, Craig

ANS 308 Advanced Selecting Dairy and Meat Animals 1 (0-3) s
Prerequisite: ANS 302
Intensive practice on developing proficiency in selecting techniques for dairy and meat animals with emphasis on oral reasons. Visits will be made to leading farms to study different breeds. Messrs. Gregory, Murley

ANS 309 (FS 309) Meat Selection 1 (0-6) f
Detailed consideration of factors involved in selection of carcasses and wholesale cuts of beef, pork and lamb. Practice in identification of wholesale and retail cuts. Mr. Blumer

ANS 312 Principles of Livestock Nutrition 3 (3-0) s
Prerequisites: CH 220, ZO 421
Fundamentals of modern animal nutrition, including classification of nutrients, their general metabolism and roles in productive functions.
Mr. Ramsey

ANS 404 Dairy Farm Problems 3 (2-3) s
Prerequisite: ANS 201
Advanced study of practical dairy farm management including farm records, farm buildings, sanitation, roughage utilization and herd culling.
Mr. Murley

ANS 407 Advanced Livestock Production 3 (3-0) s
Prerequisites: GN 411, ANS 312
A study of the economic, nutritional, genetic, physiological and managerial factors affecting the operation of commercial and purebred livestock enterprises. Messrs. Clawson, Goode, Wise

ANS 408 Reproduction and Lactation 3 (2-3) s
Prerequisite: ZO 421
Anatomy of the reproductive organs and mammary glands with detailed coverage of the physiological processes involved and of factors controlling and influencing them. A special research problem selected by the student is required. Messrs. Mochrie, Myers, Ulberg

ANS 409 Advanced Livestock Production Lab 1 (0-3) s
Prerequisites: GN 411, ANS 312
A study of the economic, nutritional, genetic, physiological and managerial factors affecting the operation of commercial and purebred livestock enterprises. Laboratory.

ANS 490 Animal Science Seminar 1 (1-0) s
Review and discussion of special topics and the current literature pertaining to all phases of animal science. Mr. Porterfield

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ANS 503 (GN 503) Genetic Improvement of Livestock 3 (2-3) f
Prerequisite: GN 411 or consent of instructor
The application of genetic principles to the economic improvement of animal agriculture. Phenotypic and genetic relationships among economic traits as well as mode of inheritance and method of measurement of the traits. The role of inbreeding, outbreeding and selection methods in producing superior genetic populations. Mr. Robison

ANS 505 Diseases of Farm Animals 3 (3-0) f

Prerequisites: CH 101, CH 103, BO 412 desired

The pathology of bacterial, virus, parasitic, nutritional and thermal diseases, and mechanical disease processes. Mr. Batte

ANS 513 Needs and Utilization of Nutrients by Livestock 3 (3-0) s

Prerequisite: ANS 312 or equivalent

Measurement of nutrient needs of livestock and the nutrient values of feeds. Nutritive requirements for productive functions. Mr. Wise

ANS 590 Topical Problems in Animal Science maximum 6 f s

Special problems may be selected or assigned in various phases of Animal Science. A maximum of six credits is allowed. Staff

COURSES FOR GRADUATES ONLY

ANS 602 (GN 602) Population Genetics in Animal Improvement 3 arranged f

Prerequisites: ST 512, GN 512

A study of the forces influencing gene frequencies, inbreeding and its effects, and alternative breeding plans. Mr. Legates

ANS 604 (ZO 604) Experimental Animal Physiology 4 (2-4) f

Prerequisite: ZO 513 or equivalent

A study of the theories and techniques involved in the use of animals in physiological investigation. Messrs. Ulberg, Wise

ANS 614 (BO 614) Bacterial Metabolism 2 credits s

Prerequisites: BO 514 or equivalent, CH 551

The energy metabolism of bacteria; synthesis of carbohydrates, lipids, proteins, purines, pyrimidines, and nucleic acids; bacterial photosynthesis; enzyme formation and metabolic control mechanisms; active transport systems. Mr. McNeill

ANS 622 (ST 622) Principles of Biological Assays 3 (2-2) s

Prerequisites: CH 551, ST 512

Techniques and designs of biological assays for vitamins. The interrelationship of logical principles, design, and analysis is emphasized. Mr. Smart

ANS 653 (CH 653) Mineral Metabolism 3 (3-0) f

Prerequisite: CH 551

Principles of mineral metabolism with emphasis on metabolic functions, reaction on mechanisms and interrelationships. Mr. Matrone

ANS 690 Seminar in Animal Nutrition 1 (1-0) f s

Prerequisite: Permission of seminar leaders

Orientation in philosophy of research; preparation for research in agriculture, and general research methodology. Nutrition Staff

ANS 699 Research in Animal Science credits by arrangements f s

A maximum of six hours allowed toward the master's degree; no limitation on credits in doctorate programs.

ANTHROPOLOGY

(Also see Sociology)

COURSES FOR UNDERGRADUATES

ANT 251 Physical Anthropology 3 (3-0) f

The study of the development of man as a species; analysis of the formation and spread of races; introduction to archaeology as a study of the material remains of ancient man and his activities.

ANT 252 Cultural Anthropology 3 (3-0) f s

The analysis of various living societies and their cultures in terms of social adjustment to recurrent needs.

ANT 305 Peoples of the World 3 (3-0) f s

This course seeks to develop insights of wide applicability concerning human relationships and the adjustment of man to his geographical, social, and cultural environments. The course is designed to demonstrate interrelationships among diverse factors affecting human behavior in all societies.

ANT 410 Theories of Culture 3 (3-0) s

Prerequisites: Six hours of Sociology and ANT 252 or equivalent

The study of major anthropological theories of culture with intensive analysis of their application.

ARCHITECTURE

COURSES FOR UNDERGRADUATES

ARC 201 Architectural Design I 4 (3-6) f s

Prerequisite: DN 102

Introductory exercises in architectural design. The design of small buildings of specific function and simple construction which can be related to the student's experience; emphasis on the influence of environment, climate, etc. Study of the materials of construction with special emphasis on light wood framing, millwork, masonry, tile, and terrazzo. Messrs. Hix, Wodehouse

ARC 300 Historic Architecture Research 2 credits s

Prerequisites: ARC 201, LAR 201

Research and the recording of sites, monuments, buildings, or artifacts of historical interest. Mr. Shogren

ARC 301, 302 Architectural Design II, III 5 (3-9) f s

Prerequisites: ARC 201, EM 211, LAR 201, PY 211

Continuing exercises in architectural design, based on larger buildings with more complex interior and exterior relationships. Emphasis on the problems of functional planning, research on building requirements, and recognized methods of construction. Architectural concrete, acoustical materials, plaster, and drywall construction; second semester: miscellaneous metals, metal doors and windows. Messrs. Nichols, Tereszczenko

ARC 401, 402 Architectural Design IV, V 6 (3-12) f s

Prerequisites: ARC 302, CE 339, EM 212

The design of large buildings or building complexes and economic and sociological influences on them, stressing the use of technology and indus-

trialization. Emphasis on the logical coordination of the many factors of building design. Curtain wall construction, caulking and sealants; second semester: hardware, paints, and thermal insulation.

Messrs. Harris, Shawcroft

ARC 421, 422 Structural Design I, II 3 (3-3) f s

Prerequisite: CE 339

Principles and applications of steel and timber design; principles and application of reinforced concrete design; and elements of foundations.

Mr. Kahn

ARC 431, 432 Environmental Factors 3 (3-0) f s

An investigation of environmental factors affecting architectural design. Heating and cooling systems; and controls and principles of plumbing including venting, drainage, demand and load calculations, water distribution, pipe sizing, storm drainage and sprinkler systems. Lighting and acoustical design and electrical equipment and design. Mr. Kahn

ARC 501, 502 Architectural Design VI, VII 6-8 (3-12) f s

Prerequisites: ARC 402, ARC 300

A continuation of ARC 401, 402 with special emphasis on the development of arch-typical designs and the use of subjective selection by the designer. An architectural thesis is required in the spring semester.

Mr. Glowczewski

ARC 511, 512 Professional Practice I, II 2 (2-0) f s

Prerequisite: Fourth year standing

A study of form and content of contracts, specifications, and standard contract documents; relationship and responsibilities of architects to clients and third parties; legal and ethical consideration of architectural practice; office organization. Mr. Boaz

ARC 531, 532 Structural Design III, IV 2 (2-2) f s

Prerequisite: ARC 422

Comparative study of structures and structural elements; their possibilities and limitations; review and discussion of structural principles, Engineering consultation. Mr. Kahn

ART

ART 200 The Visual Arts in Contemporary Life 3 (3-0) f

Study of painting, sculpture, art, crafts, and the useful arts of commerce; the aesthetic nature of man from the standpoint of creativity and appreciation; relation of present day creative efforts of man with those of the past, giving the student an understanding of today's visual arts.

BIOLOGICAL SCIENCES

BS 100 General Biology 4 (3-2) f s

A course designed to emphasize the unit of biology through study of the following concepts: 1) protoplasmic and cellular organization, 2) growth and differentiation, 3) genetic and ecological control and 4) current and past evolution.

BS 571 (ST 571, MA 571) Biomathematics I 3 (3-0)

BS 572 (ST 572, MA 572) Biomathematics II 3 (3-0)

BOTANY AND BACTERIOLOGY

COURSES FOR UNDERGRADUATES

BS 100 General Biology 4 (3-2) f s
(See listing under Biological Sciences.)

BO 214 Dendrology 4 (2-4) s
Prerequisite: BS 100

A systematic survey of the evergreen (gymnosperm) and hardwood (angiosperm) genera and species of North American trees. Emphasis is upon terminology, structure, relationships, and identification of woody plants.
Mr. Hardin

BO 301 General Morphology 4 (3-3) f
Prerequisite: BS 100

A survey of the principal groups of plants from the standpoint of their structure, development and reproduction. Emphasis is placed on evolutionary relationships as revealed by comparisons in body organizaton and life histories of living and extinct forms. Some time is spent on general identification of the plants in their native habitats. Mr. Hardin

BO 403 Systematic Botany 3 (0-6) s
Prerequisite: BS 100

A systematic survey of vascular plants emphasizing field identification, terminology, and general evolutionary relationships. Mr. Beal

BO 412 General Microbiology 4 (3-2) f
Prerequisites: CH 107 or CH 103 (CH 221 or CH 220 recommended but not required)

An advanced biology course dealing with bacteria and other microorganisms, their structure, development, and function. Emphasis is placed on the fundamental concepts and techniques in microbiology such as isolation, cultivation, observation, morphology, and the physiology and nutrition of bacteria. The applications of microbiology, the role of microbes in nature, and their role in infection and immunity are considered. Mr. Elkan

BO 421 Plant Physiology 4 (2-4) f s
Prerequisites: BS 100, 2 courses in Chemistry

An introductory treatment of the chemical and physical processes occurring in higher green plants with emphasis upon the mechanisms, factors affecting, correlations between processes, and biological significance.
Messrs. Scofield, Troyer

BO 442 (ZO 442) General Ecology 4 (3-3) f
Prerequisite: BS 100

The general principles of the interrelationships among organisms, and organisms and their environments—land, fresh-water, and marine.
Messrs. Cooper, Quay

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

BO 505 (FS 505) Food Microbiology 3 (2-3)

BO 506 (FS 506) Advanced Food Microbiology 3 (0-9)

BO 511 Advanced Bacteriology 3 (1-4) s

Prerequisite: BO 412

This course will present the principles and techniques of isolation and characterization of bacteria from a wide range of habitats. Particular stress will be given to the principles of enrichment techniques, differential and selective media, and pertinent diagnostic tests that are applicable to particular groups of bacteria. Messrs. Evans, Perry

BO 512 Morphology of Vascular Plants 3 (1-6) f

Prerequisite: BS 100

A study of comparative morphology, ontogeny and evolution of the vascular plants. Emphasis is placed upon the phylogeny of sexual reproduction and of vascular systems. Mr. Ball

BO 513 Plant Anatomy 3 (1-6) s

Prerequisite: BS 100

A study of the anatomy of the Angiosperms and Gymnosperms. The development of tissues is traced from their origin by meristems to their mature states. Mr. Ball

BO 514 Introductory Bacterial Physiology 3 (3-0) f

Prerequisites: BO 412, CH 220 or CH 221, CH 551 (may be taken concurrently)

Emphasis will be placed on general principles and function with respect to the living cell. Included will be a study of cell structure, growth, death, reproduction, nutrition and metabolism. An attempt will be made to illustrate the application of basic principles to applied areas of bacteriology and to other areas of basic science. Messrs. Dobrogosz, Evans

BO 521 Systematic Botany of Monocot Families 3 (0-6) f

Prerequisites: BS 100, BO 403

A comprehensive survey of the systematics and evolution of monocot families. Special emphasis is given to terminology, morphology, identification and relationships. (Offered alternate years. Not given in 1964-65.)
Mr. Beal

BO 523 Systematic Botany of Dicot Families 3 (2-3) s

Prerequisites: BS 100, BO 403

A comprehensive survey of the systematics and evolution of dicot families. Special emphasis is given to terminology, morphology, identification and relationships. (Offered alternate years. Not given in 1964-65.)
Mr. Hardin

BO 531 (SSC 532) Soil Microbiology

BO 535 Water, Solute and Gas Relations of Plants 2 (2-0) f

Prerequisite: BO 588

An advanced treatment of processes of higher plants involving exchange of materials between the plant and its surroundings and movement of materials within the plant. Theoretical principles are emphasized.
(Offered alternate years. Given in 1964-65.) Mr. Troyer

BO 536 Growth and Development of Plants 2 (2-0) f

Prerequisite: BO 588

An advanced treatment of the physiology of growth and development of higher plants, with emphasis on theoretical principles.
(Offered alternate years. Not given in 1964-65.) Mr. Troyer

BO 544 PLANT GEOGRAPHY 3 (3-0) s

Prerequisites: BO 403, BO 442, GN 411

A course in descriptive and interpretive plant geography, synthesizing data from the fields of ecology, genetics, geography, paleobotany and taxonomy. The course will include a survey of the present distribution of major vegetation types throughout the world, a discussion of the history and development of this present pattern of vegetation, and a discussion of the principles and theories of plant geography.
(Offered alternate years. Given in 1964-65.)

BO 545 ADVANCED PLANT ECOLOGY 3 (2-3) s

Prerequisites: BO 421, BO 442

An advanced consideration of plant ecology through class discussions and laboratory work. The first half of the course is a consideration in depth of microenvironments, and the second half a treatment of the principles and theories of plant ecology.
(Offered alternative years. Not given in 1964-65.) Mr. Cooper

BO 561 (GN 561) BIOCHEMICAL AND MICROBIAL GENETICS 3 credits

BO 570 (CE 570) SANITARY MICROBIOLOGY 3 (2-3) s

Prerequisite: BO 412 or consent of instructor

Fundamental aspects of microbiology and biochemistry are presented and related to problems of stream pollution, refuse disposal and biological treatment. Laboratory exercises present basic microbiological techniques and illustrate from a chemical viewpoint some of the basic microbial aspects of waste disposal. Mr. Elkan

BO 574 PHYCOLOGY 3 (1-4) s

Prerequisite: BS 100

An introduction to the classes of algae. The systematic position, life history, and ecology of important genera in the local flora, both fresh-water and marine, are emphasized. Mr. Whitford

BO 588 (ZO 588) CELL PHYSIOLOGY 3 (3-0) s

Prerequisite: BO 421 or ZO 301 or permission of instructor

A study of fundamental physiological properties at the cellular level with emphasis on theoretical principles. Messrs. Santolucito, Troyer

BO 589 (ZO 589) CELL PHYSIOLOGY LABORATORY 1 (0-3) s

Prerequisites: BO 588 (ZO 588) (may be taken concurrently) and permission of instructor

Experimental approaches in the study of physiological processes at the cellular level. Attention will be devoted to the theoretical usefulness of laboratory techniques along with their practical limitations.

COURSES FOR GRADUATES ONLY

BO 614 (ANS 614) BACTERIAL METABOLISM

BO 620 ADVANCED TAXONOMY 3 (2-2) f

Prerequisites: BO 521, BO 523 or permission of instructor

A course in the principles of plant taxonomy including the history of taxonomy, systems of classification, rules of nomenclature, taxonomic literature, taxonomic and biosystematic methods, and monographic techniques.
(Offered alternate years. Given in 1964-65.) Mr. Hardin

BO 635 The Mineral Nutrition of Plants 3 (2-3) s

Prerequisites: BO 421 and a course in Biochemistry

Discussion of diffusion, molecular specificity and energetics of active transport. The physical chemistry of the essential elements and its significance to their biochemical functions. Mr. Kahn

BO 636 Discussions in Plant Physiology 1 (1-0) f

Prerequisite: BO 588

Group discussions at an advanced level of selected topics of current interest in plant physiology. Mr. Troyer

BO 690 Bacteriology Seminar 1 (1-0) f s

Scientific articles, progress reports in research, and special problems of interest to bacteriologists are reviewed and discussed. Credit is allowed if one paper per semester is presented at seminar. Graduate Staff

BO 691 Botany Seminar 1 (1-0) f s

Scientific articles, progress reports in research, and special problems of interest to botanists are reviewed and discussed. Credit is allowed if one paper per semester is presented at seminar. Graduate Staff

BO 692 Special Problems in Bacteriology credits by arrangements f s

Directed research in some special phase of bacteriology other than a thesis problem but designed to provide experience and training in research. Graduate Staff

BO 693 Special Problems in Botany credits by arrangement f s

Directed research in some special phase of botany other than a thesis problem but designed to provide experience and training in research. Graduate Staff

BO 699 Research credits by arrangement f s

Original research preparatory to writing the M. S. thesis or Ph.D. dissertion in botany or bacteriology. Graduate Staff

CERAMIC ENGINEERING

COURSES FOR UNDERGRADUATES

MIC 210 Ceramic Materials and Processes 3 (2-3) f s

Designed for students not majoring in Ceramic Engineering. Includes raw materials, forming processes, effect of thermal treatment, properties and uses of ceramic products. Lecture and Laboratory.

MIC 218 Introduction to Ceramic Engineering 4 (3-3) s

Prerequisite: CH 103 or CH 107

Calculation of material balances and stoichiometric relations in ceramic systems. Structure and properties of raw materials and process unit operations prior to forming are treated. Lecture and Laboratory.

MIC 305 Ceramic Forming and Fabrication Processes 4 (3-3) f

Prerequisite: MIC 218

A detailed study of basic chemical and physical laws governing the behavior of various ceramic compositions in a wide variety of forming processes. Emphasis is placed on specific equipment parameters, economic considerations and the influence of the process on the properties of fabricated ceramics. Lecture and Laboratory.

MIC 306 Thermal Processing 4 (3-3) s

Prerequisite: MIC 305

Dewatering, drying and thermal processing systems. Properties of air, air-vapor mixtures, and liquids. Fuels, combustion, and heat transfer. Emphasis is placed on fundamental behavior, data interpretation, and calculation methods. Lecture and Laboratory.

MIC 415, 416 Ceramic Engineering Design 3 (1-5) f s

Prerequisites: MIC 306, EM 301

A two semester study to encourage creative solutions to problems of current interest and need in the ceramic profession. Discussion of sources of data, design principles, creativity, optimization, economic value analysis and decision making. Individual and team study involving interdependence of plant layout, processes, equipment and materials in the design of engineering systems or sub-systems. Study of design factors in utilization of ceramics in materials systems. Lecture and Laboratory.

MIC 430 Research and Control Methods 3 (2-3) f

Prerequisite: MIC 306

Interpretation of results, instrumental methods applied to research and product development. Statistical quality control. Lecture and Laboratory.

MIC 431 Reaction Kinetics in Ceramic Systems 4 (3-3) s

Prerequisites: MIM 201, CH 431

A study of reactions taking place during thermal treatment of ceramic systems. Such topics as thermodynamics, hetrogeneous phase equilibria, diffusion, solid state reactions, nucleation and grain growth are included. Lecture and Laboratory.

MIC 432 Principles of the Glassy Phase 4 (3-3) f

Prerequisite: MIC 431

A study of the glassy state to include the structure, properties, and types of glasses (including glazes and enamels). Opacity, color and devitrification. Nature of the glassy phase in kiln fired ceramics. Lecture and Laboratory.

MIC 433 Ceramic Microstructure and Properties 4 (3-3) s

Prerequisite: MIC 431

A study of the properties and behavior of processed ceramics from the standpoint of their phase characterization, atomic, micro- and macrostructure. Characteristics of ceramics are interpreted in terms of basic mechanisms affecting thermal, electronic, magnetic, mechanical, optical and nuclear properties. Emphasis is placed on process treatment and environment effects. Lecture and Laboratory.

MIC 451 Principles of Ceramic Engineering 3 (3-0) f

Prerequisite: CH 433 or ME 302 or CHE 315

An advanced treatment of fundamental relationships among ceramic materials, processes, and properties. Designed to provide an adequate background for students from other engineering and physical science curricula to permit effective study of ceramic engineering at the graduate level. Lecture.

MIC 491 Seminar 1 (1-0) f s

One semester required of seniors in Ceramic Engineering. A second semester may be elected. Literature survey of selected topics in Ceramic Engineering. Oral and written reports, discussions.

MIC 501, 502 Ceramic Structural Analysis 3 credits f s

Prerequisite: MIG 331

Basic laws of crystal structures. Arrangement of ions in crystals. Estimation of phases present in multi-component systems utilizing X-ray techniques. Analysis of glass structure. Correlation of structure with composition and properties. Lecture.

MIC 503 Ceramic Microscopy 3 (2-3) f

Prerequisite: MIG 331

Petrographic and metallographic techniques for the systematic study of ceramic materials and products. Interpretation and representation of results. Lecture and Laboratory.

MIC 506 Electron Microscopy 3 credits f

Prerequisite: MIC 503 or PY 404 or EE 507

The theory of the realization of electrostatic and magnetic lenses for electron microscopy. Major emphasis is placed on interpretation of electron diffraction, and surface replications of ceramics and metals. Lecture and Laboratory.

MIC 509 High Vacuum Technology 3 credits s s

Prerequisite: CH 433 or ME 301

Properties of low pressure gases and vapors. Production, maintenance and measurement of high vacuum; design, construction, and operation of high vacuum, high temperature facilities. Properties and reactions of materials which are processed, tested, and/or utilized in high vacuum environments. Lecture and Laboratory.

MIC 527 Refractories in Service 3 (3-0) s

Prerequisite: CH 433

A study of the physical and chemical properties of the more important refractories in respect to their environment in industrial and laboratory furnaces. Lecture.

MIC 529 Properties of High Temperature Materials 3 (3-0) s

Prerequisite: MIM 201

Effect of temperature on the physical, mechanical and chemical properties of inorganic materials; relationship between microstructure and high temperature properties; uses of ceramics, cermets, and metals at extremely high temperatures. Lecture.

MIC 533, 534 Advanced Ceramic Engineering Design 3 credits f s

Prerequisites: MIC 416, MIC 433

Advanced studies in analysis and design of ceramic products, processes, and systems leading to original solutions of current industrial problems and the development of new concepts of manufacturing. Lecture and Laboratory.

MIC 540 Glass Technology 3 (3-0) f

Prerequisite: MIC 432

Fundamentals of glass manufacture including composition, properties and applications of the principal types of commercial glasses. Lecture.

MIC 548 Technology of Cements 3 (3-0) s

Prerequisite: MIC 431

The technology of the Portland cement industry including manufacture, control and uses. Lecture.

MIC 596, 597 Advanced Ceramic Experiments 3 credits f s

Prerequisite: MIC 430 or equivalent

Advanced studies in ceramic laboratory experimentation. Laboratory.

COURSES FOR GRADUATES ONLY

MIC 601 Ceramic Phase Relationships 3 (3-0) s

Prerequisite: Consent of instructor

Heterogeneous equilibrium, phase transformations, dissociation, fusion, lattice energy, thermodynamic properties of ionic phases and silicate melts. Lecture.

MIC 603 Advanced Ceramic Reaction Kinetics 3 (3-0) s

Prerequisites: MIC 431, MIC 501

Fundamental study of the kinetics of high temperature ceramic reactions such as diffusion, nucleation, grain growth, recrystallization, phase transformation, vitrification and sintering. Lecture.

MIC 611 Ceramic Process Analysis 3 (3-0) f

Prerequisite: MIC 502

Corequisite: ST 516

Analysis of experimental and production data for ceramic processes. Quantitative evaluation of the effect of materials, materials preparation, heat distribution, composition, and other variables on properties. Sampling from production. Linear programming to compound glass and cement batches. Lecture.

MIC 621 The Vitreous State 3 (3-0) s

Prerequisite: MIC 540

An advanced study of binary and ternary silicate and borate glasses. Influence of structure on the properties of vitreous systems.

MIC 631, 632 Advanced Physical Ceramics I and II 3 credits f s

Corequisites: MIC 501, MIC 502 or MIM 521, MIM 522 or EM 501, EM 502 or PY 503, PY 552

Lattice structures and lattice energies in crystalline ceramics; relationships with elastic, optical, and thermal properties. Effects of constitution and microstructure on lattice-sensitive properties. The defect crystalline state in ceramics; vacancies, color centers, dislocations, boundaries. Crystal growth. Plastic deformation processes, including creep and fatigue; the ductile-brittle transition. Structure-sensitive properties of crystalline, vitreous and composite ceramics; effects of constitution, microstructure, non-stoichiometry. Lecture and Laboratory.

MIC 635, 636 Electronic Ceramics 3 (3-0) summer

Prerequisites: MA 441, PY 414 or PY 407

Lattice energy, dielectric and optical properties of insulators, ferroelectrics, magnetic oxides, electron distribution in insulators and semi-conductors; electronic properties of alkali halides. Lecture.

MIC 695 Ceramic Engineering Seminar 1 (1-0) f s

Reports and discussion of special topics in ceramic engineering and allied fields. Lecture.

MIC 697 Special Studies in Ceramic Engineering 1 to 3 credits

Special studies of advanced topics in ceramic engineering. Credit will vary with the topic.

MIC 699 Ceramic Research 1 to 9 credits

An original and independent investigation in ceramic engineering. A report of such an investigation is required as a graduate thesis.

CHEMICAL ENGINEERING

CHE 205 Chemical Process Principles 4 (3-2) s

Prerequisites: CH 103 or CH 107, MA 201

Required of sophomores in Chemical Engineering.

The calculation of material and energy balances, stoichiometry, gas laws, vapor pressure, humidity, saturation, thermophysics and thermochemistry.

Mr. Bright

CHE 301, 302 Elements of Chemical Engineering 3 (3-0) f s

An introduction to principles of Chemical Engineering including calculations involved in industrial processes and equipment. The course is designed for students not majoring in Chemical Engineering.

Mr. Bright

CHE 307 Introductory Chemical Engineering 3 (3-0) f s

Prerequisite: CHE 205

Basic principles of fluid flow, heat transfer, and mass transfer with emphasis on application to design of chemical processes and equipment.

Mr. Bright

CHE 311, 312 Transport Processes I, II 3 (3-0) f s

Prerequisites: MA 301, PY 208, CHE 205

Required of juniors in Chemical Engineering.

An introduction to momentum, heat, and mass transport processes, with emphasis on chemical engineering. Problems in fluid dynamics and heat transfer.

Mr. Marsland

CHE 315 Chemical Process Thermodynamics 3 (3-0) s

Prerequisites: CHE 205, MA 301

Required of juniors in Chemical Engineering.

A study of the laws of thermodynamics and their application to chemical engineering problems, both in theory and in practice. Criteria of equilibrium in physical and chemical changes. Behavior of real fluids, including mixtures.

Mr. Beatty

CHE 421, 422 Reactor Energy Transfer I, II 3 (3-0) f s

Prerequisites: MA 202, PY 208

Thermodynamics, heat transfer and fluid flow with emphasis on the problems and methods used in the design and analysis of nuclear reactors.

Mr. Ferrell

CHE 425 Process Measurement and Control 3 (2-2) s

Prerequisite: CHE 312

Required of seniors in Chemical Engineering.

Theory and application of methods for measuring, recording, transmitting and controlling process variables. The techniques of analysis, beginning with process elements in automatic control and proceeding through system analysis, are employed. Commercial instruments are available for simulating industrial control problems.

Mr. Seely

CHE 427, 428 Separation Processes I, II 3 (3-0) f s

Prerequisite: CHE 311

Required of seniors in Chemical Engineering.

A study of the principles underlying such unit operations as absorption, extraction, distillation, drying, filtration, etc., with emphasis on procedures and economic considerations. Mr. Stahel

CHE 431 Chemical Engineering Laboratory I 2 (0-6) s

Prerequisite: CHE 311

Required of juniors in Chemical Engineering.

Laboratory work on typical apparatus involving unit operations. Experiments are designed to augment the theory and data of lecture courses and to develop proficiency in the writing of technical reports. Mr. Seely

CHE 432 Chemical Engineering Laboratory II 2 (0-6) f

Prerequisite: CHE 312

Required of seniors in Chemical Engineering.

A continuation of CHE 431. Mr. Seely

CHE 433 Chemical Engineering Laboratory III 2 (0-6) s

Prerequisite: CHE 427

Required of seniors in Chemical Engineering.

A continuation of CHE 432. Mr. Seely

CHE 446 Chemical Process Kinetics 3 (3-0) f

Prerequisite: CHE 315

Required of seniors in Chemical Engineering.

A basic study of homogenous and heterogenous chemical reactions, and of catalysis. Mr. Stahel

CHE 495 Seminar 1 (1-0) f s

One semester required of seniors in Chemical Engineering.

Professional aspects of chemical engineering; topics of current interest in chemical engineering. Mr. Schoenborn

CHE 497 Chemical Engineering Projects 2 arranged f s

Elective for seniors in Chemical Engineering.

Introduction to research through experimental, theoretical and literature studies of chemical engineering problems. Oral and written presentation of reports. Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

CHE 511 Problem Analysis for Chemical Engineers 3 (3-0)

Prerequisites: CHE 428, MA 301

The application of the methods of mathematical analysis to the formulation and solution of problems in transport phenomena, transient phenomena in unit operations, process dynamics, and thermodynamics. Study and use of analog computer solutions of these problems. Mr. Ferrell

CHE 513 Thermodynamics I 3 (3-0)

Prerequisite: CHE 315

An intermediate course in thermodynamic principles and their application to chemical and phase equilibria. The course is largely from a macroscopic viewpoint but consideration will be given to some aspects of the statistical viewpoint. Mr. Beatty

CHE 515 Transport Phenomena 3 (3-0)

Prerequisite: CHE 312

A theoretical study of transport of momentum, energy, and matter with emphasis on the latter two. The diffusional operations, including coupled heat and mass transfer, are introduced in the light of the theory.

Mr. Marsland

CHE 517 Kinetics and Catalysis 3 (3-0)

Prerequisite: CHE 446

An intensive study of homogeneous and heterogeneous kinetic reactions. Emphasis will be placed on fundamental approaches, experimental methods, and mathematical techniques in engineering analysis of chemical reaction systems. Mr. Stahel

CHE 540 Electrochemical Engineering 3 (3-0)

Prerequisite: Physical Chemistry

The application of electrochemical principles to such topics as electrolysis, electroanalysis, electroplating, metal refining, etc. Mr. Schoenborn

CHE 541 Cellulose Industries 3 (3-0)

Prerequisite: Organic Chemistry

Methods of manufacture and application of cellulose chemical conversion products. Emphasis placed on recent development in the field of synthetic fibers, films, lacquers, and other cellulose compounds. Mr. Seely

CHE 543 Technology of Plastics 3 (3-0)

Prerequisite: Organic Chemistry

The properties, methods of manufacture, and applications of synthetic resins. Recent developments in the field are stressed. Mr. Seely

CHE 551 Thermal Problems in Nuclear Engineering 3 (3-0)

Prerequisite: ME 302 or ME 303 or CHE 311 or equivalent

The design and operation of nuclear reactors and the utilization of the power from them involves major problems in nearly every phase of heat transfer, and many important problems in fluid flow. Possible solutions to these problems are severely affected by the influence of radiation on heat transfer media, hazards of handling radioactive substances, etc. The course considers the thermal problems of nuclear reactor design and the principles of fluid flow and heat transfer necessary to their solutions.

The course is intended for engineers and science students with backgrounds in physics and mathematics and elementary thermodynamics.

Mr. Beatty

CHE 597 Chemical Engineering Projects 1 to 3 arranged f s

Prerequisite or corequisite: CHE 412

A laboratory study of some phase of chemical engineering or allied field.

Graduate Staff

CHEMISTRY

COURSES FOR UNDERGRADUATES

CH 101 General Chemistry I 4 (3-3) f s

CH 101 and 103 provide instruction in the language of chemistry, fundamental chemistry laws and theories, preparation and properties of elements and their compounds, homogeneous and heterogeneous equilibria, oxidation-reduction, and an introduction to organic and to nuclear chemistry.

CH 103 General Chemistry II 4 (3-3) f s

Prerequisite: CH 101

A continuation of CH 101. The laboratory work consists of semimicro qualitative analysis and some quantitative experiments.

CH 105 Principles of Chemistry I 4 (3-3) f s

CH 105 and 107 are similar to CH 101 and 103, but with greater emphasis on atomic structure, ionic equilibria, transition metals, and coordination chemistry. These courses are designed for students who plan to take advanced courses in chemistry.

CH 106 Laboratory Techniques I 1 (0-3) f

Corequisite: CH 105

Laboratory work to supplement the laboratory of CH 105.

CH 107 Principles of Chemistry II 4 (3-3) f s

Prerequisite: CH 105

A continuation of CH 105. The laboratory work consists of semimicro qualitative analysis and some quantitative experiments.

CH 108 Laboratory Techniques II 1 (0-3) s

Corequisite: CH 107

Laboratory work to supplement the laboratory of CH 107, including some elementary quantitative analysis and inorganic preparations.

CH 215 Quantitative Analysis 4 (3-3) f s

Prerequisite: CH 103 or CH 107

A one-semester course in volumetric and gravimetric analysis including techniques, stoichiometry, and principles of neutralization, oxidation-reduction, and precipitation methods.

CH 220 Introductory Organic Chemistry 4 (3-3) f s

Prerequisite: CH 103 or CH 107

An introduction to the fundamental principles of organic chemistry included in the study of the hydrocarbons, alcohols, ethers, aldehydes, ketones, acids and their derivatives, esters, phenols, fats, carbohydrates, amino acids, proteins, and a selected group of natural and synthetic products.

CH 221 Organic Chemistry I 4 (3-3) f s

Prerequisite: CH 103 or CH 107

CH 221 and 223 cover the fundamentals of organic chemistry, including both aliphatic and aromatic compounds.

CH 223 Organic Chemistry II 4 (3-3) f s

Prerequisite: CH 221

A continuation of CH 221.

CH 231 Introductory Physical Chemistry 4 (3-3) f s

Prerequisites: CH 103 or CH 107, MA 102 or MA 112

Designed for students whose background in mathematics and physics is not sufficient to meet the requirements of CH 431-433, but who desire instruction on chemical principles in addition to that provided at the freshman level.

CH 351 Introductory Biochemistry 3 (2-3) f s

Prerequisite: CH 220 or CH 223

The fundamental chemistry of living matter.

CH 401 Systematic Inorganic Chemistry 3 (3-0) s

Corequisite: CH 433

A survey of the chemical elements based on atomic structure and the periodic system, also introducing newer concepts of structure and symmetry. A knowledge of basic physical chemical principles is prerequisite.

CH 411 Analytical Chemistry I 4 (2-6) f

Prerequisites: CH 431, CH 432

Corequisite: CH 433

An introduction to analytical chemistry, including both classical and modern techniques involving the distribution of a component between phases, for example, gravimetric methods, gas chromatography, and adsorption.

CH 413 Analytical Chemistry II 4 (2-6) s

Prerequisite: CH 411

A continuation of Analytical Chemistry I, with emphasis upon modern approaches to acid-base chemistry, oxidation-reduction, potentiometric methods, and spectrophotometry.

CH 428 Qualitative Organic Analysis 3 (1-6) f

Prerequisite: CH 223

An introduction to the identification of organic compounds by means of physical properties (including infrared spectra), chemical classification tests, and preparation of derivatives.

CH 431 Physical Chemistry I 3 (3-0) f s

Prerequisites: CH 107, MA 202, PY 207 or PY 208

CH 431 and 433 provide an intensive study of the states of matter, solutions, colloids, homogeneous and heterogeneous equilibrium, reaction kinetics, electrolysis, conductance, oxidation reactions, and ionic equilibrium.

CH 432 Physical Chemistry I Laboratory 1 (0-3) f

Corequisite: CH 431

Laboratory course to accompany the lecture work in CH 431.

CH 433 Physical Chemistry II 3 (3-0) f s

Prerequisite: CH 431

A continuation of CH 431.

CH 434 Physical Chemistry II Laboratory 1 (0-3) s

Corequisite: CH 433

Laboratory course to accompany the lecture work in CH 433.

CH 435 Physical Chemistry III 3 (3-0) f

Prerequisite: CH 433

An intensive study of the structure of atoms and molecules, an introduction to statistical mechanics, and selected topics in modern physical chemistry.

CH 441 Colloid Chemistry 3 (2-3) s

Prerequisites: CH 220, CH 215

Adsorption; preparation, properties, constitution, stability, and application of sols, gels, emulsions, foams, and aerosols; dialysis; Donnan membrane equilibrium.

CH 490 Chemical Preparations 3 (1-6) f s

Prerequisite: Three years of Chemistry

Lectures and laboratory work in preparative chemistry. Synthetic pro-

cedures will be selected to illustrate advanced methods and techniques in both inorganic and organic chemistry.

CH 491 Reading in Honors Chemistry 2 to 6 credits by arrangement f s
Prerequisite: Three years of Chemistry
A reading course for exceptionally able students at the senior level. The students will do extensive reading in areas of advanced chemistry and will present written reports of their findings.

CH 493 Chemical Literature 1 (1-0) f
Prerequisite: Three years of Chemistry
A systematic introduction to the location and retrieval of information required for the solution of chemical problems.

CH 499 Senior Research 1 to 3 credits by arrangement f s
Prerequisite: Three years of Chemistry
An introduction to research. Independent investigation of a research problem under the supervision of a member of the chemistry faculty.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

CH 501 Inorganic Chemistry I 3 (3-0) f
Prerequisite: CH 433
Modern inorganic chemistry from the point of view of the chemical bond. Chemical periodicity and its origins in atomic structure, the ionic bond and electronegativity, crystal structure and bonding in ionic solids, the metallic state, conduction and semiconductors, and the preparation and properties of illustrative compounds.

CH 503 Inorganic Chemistry II 3 (3-0) s
Prerequisite: CH 501
The hydrogen molecule-ion and the theory of the covalent bond, molecular orbitals and hydridization, dipole moments and magnetic properties, the theory of acids and bases, non-aqueous solvents, coordination compounds, carbonyls and quasiaromatic compounds, and the chemistry of the transition metals, lanthanides, and actinides.

CH 511 Chemical Spectroscopy 3 (2-3) f
Prerequisite: CH 433
Theory, analytical applications, and interpretation of spectra as applied to chemical problems. Major emphasis will be placed upon ultraviolet, visible, and infrared spectra.

CH 513 Electroanalytical Chemistry 3 (2-3) s
Prerequisite: CH 413
Foundations of theoretical electrochemistry, potentiometric measurements and electrical resistance, diffusion and transport, theory of dilute solutions, polarography and amperometric measurements, surface effects and electrode kinetics, electro-chemistry in non-aqueous systems.

CH 521 Advanced Organic Chemistry I 3 (3-0) f
Prerequisites: Three years of Chemistry including CH 223
Resonance, reaction mechanisms, hydrocarbons, organic halides, alcohols, amines, and carbonyl compounds.

CH 523 Advanced Organic Chemistry II 3 (3-0) s
Prerequisite: CH 521
Stereochemistry of organic compounds, including steroids and other natural products.

CH 527 Chemistry of Metal-Organic Compounds 3 (3-0) f

Prerequisites: Three years of Chemistry including CH 223

Preparation, properties, and reactions of compounds containing the carbon-metal bond, with a brief description of their uses.

CH 528 Qualitative Organic Analysis 4 (1-6) f

Prerequisites: Three years of Chemistry including CH 223

A study of functional groups, separation and identification of compounds, preparation of derivatives.

CH 531 Chemical Thermodynamics 3 (3-0) f

Prerequisites: CH 433, MA 301

An extension of elementary principles to the treatment of ideal and real gases, ideal solutions, electrolytic solutions, galvanic cells, surface systems, and irreversible processes. An introduction to statistical thermodynamics and the estimation of thermodynamic functions from spectroscopic data.

CH 533 Chemical Kinetics 3 (3-0) s

Prerequisites: CH 433, MA 301

An intensive survey of the basic principles of chemical kinetics with emphasis on experimental and mathematical techniques, elements of the kinetic theory, and theory of the transition state. Applications to gas reactions, reactions in solution, and mechanism studies.

CH 535 Surface Phenomena 3 (3-0) f

Prerequisites: CH 433, MA 301

An intensive survey of the topics of current interest in surface phenomena. Formulations of basic theories are presented together with illustrations of their current applications.

CH 537 Quantum Chemistry 3 (3-0) s

Prerequisites: MA 301, CH 433 or PY 407

The elements of wave mechanics applied to stationary energy states and time dependent phenomena. Applications of quantum theory to chemistry, particularly chemical bonds.

CH 543 Radioisotope Principles 3 (3-0) f

Prerequisites: CH 433, PY 207, MA 202

A presentation of the basic knowledge of radioactivity, nuclear reactions, ionizing radiations, and radiochemistry essential to competence in the use of radioisotopes.

CH 544 Radioisotope Techniques 1 (0-3) f

Corequisite: CH 543

A laboratory course in the physical and chemical techniques essential to competence in the use of radioisotopes.

CH 545 Radiochemistry 3 (3-0) s

Prerequisites: CH 543 or PY 407, and PY 410

An advanced presentation of the applications of radioactivity to chemistry and of the applications of chemistry to the radioactive elements, particularly the heavy elements and fission products.

CH 546 Radiochemistry Laboratory 1 (0-3) s

Corequisite: CH 545

Laboratory work associated with CH 545 Radiochemistry.

CH 551 General Biochemistry 3 (3-0) f

Prerequisites: Three years of Chemistry including CH 223

The chemical constitution of living matter. Biochemical processes as well as compounds are studied.

CH 552 Biochemical Research Techniques 3 (0-8) fs

Corequisite: CH 551

A laboratory course emphasizing the techniques and methods of modern biochemical research.

CH 555 Plant Chemistry 3 (2-3) s

Prerequisite: CH 551

Composition of plants; properties, nature, and classification of plant constituents; changes occurring during growth, ripening, and storage of plant products.

CH 561 (TC 561) Chemistry of Fibers 3 (3-0) f

Prerequisite: CH 223

The theory of fiber structure; the relationship between chemical structure and physical properties of natural and man-made fibers; the nature of the chemical reactions which produce degradation of fibers; the production of man-made fibers.

CH 562 (TC 562) Chemistry of High Polymers 3 (3-0) s

Mechanisms and kinetics of polymerization; molecular weight description; theory of polymer solutions.

CH 623 Valence and the Structure of Organic Molecules 3 (3-0) f

Prerequisites: CH 223, CH 433

Applications of molecular orbital theory, thermodynamics, and free energy relations to organic problems.

CH 625 Organic Reaction Mechanisms 3 (3-0) s

Prerequisites: CH 223, CH 433

A study of the effects of structure and substituents on the direction and rates of organic reactions.

CH 651 Physical Biochemistry 3 (3-0) s

Prerequisite: CH 433

Kinetics and thermodynamics of enzyme-catalyzed reactions. Structural and physical properties of proteins and macro-molecules.

CH 653 (ANS 653) Mineral Metabolism 3 (3-0) f

Prerequisite: CH 551

Principles of mineral metabolism with emphasis on metabolic functions, reaction mechanisms, and interrelationships.

CH 655 Intermediary Metabolism I 3 (3-0) s

Prerequisite: CH 551

A study of carbohydrate, lipid, and energy metabolism.

CH 657 Intermediary Metabolism II 3 (3-0) f

Prerequisite: CH 551

A study of amino-acid, protein, and nucleic acid metabolism.

CH 659 Natural Products 3 (3-0) f

Prerequisites: Three years Chemistry including CH 521

Synthetic and degradative procedures and conformational analysis in

naturally occurring compounds, with emphasis on lipids, steroids, and carbohydrates.

CH 691 SEMINAR 1 (1-0) f s

Prerequisite: Graduate standing in Chemistry

Scientific articles, progress reports in research, and special problems of interest to chemists are reviewed and discussed.

CH 695 SPECIAL TOPICS IN CHEMISTRY maximum 3 f s

Prerequisite: Permission of head of department

Critical study of special problems in one of the branches of chemistry.

CH 699 CHEMICAL RESEARCH credits by arrangement f s

Prerequisite: Forty semester credits in Chemistry

Special problems that will furnish material for a thesis. A maximum of 6 semester credits is allowed toward a master's degree; there is no limitation on credits in the doctorate program.

CIVIL ENGINEERING

COURSES FOR UNDERGRADUATES

CE 201 ENGINEERING MEASUREMENTS IN SURVEYING 3 (2-3) f s

Prerequisite: MA 201

Required of sophomores in Civil Engineering, Civil Engineering Construction Option, Forestry, and juniors in Geological Engineering. The general theory of engineering measurement, errors, significant figures, repeated observations, precision ratios and accuracy of measurements are presented. Other lecture topics include horizontal and vertical control, stadia theory, concepts of area measurements, elements of simple curves, photogrammetry, and the basic concepts of astronomical observations.

CE 324 STRUCTURAL ANALYSIS I 3 (2-3) s

Prerequisite: EM 200

Corequisite: EM 301

Required of juniors in Civil Engineering and Civil Engineering Construction Option.

Stress analysis of statically determinate beams and framed structures under fixed and moving loads; influence line treatment for moving loads; analysis and design of a simple truss.

CE 331 STRUCTURAL MATERIALS I 3 (2-3) f s

Prerequisites: EM 200, PY 208

Required of juniors in Civil Engineering and Civil Engineering Construction Option.

Elements of materials science, experimental mechanics, materials testing for quality control. Mechanical properties of the following structural materials: metals, mineral aggregates and calcareous cements.

CE 332 STRUCTURAL MATERIALS II 3 (2-3) f s

Prerequisite: CE 331

Required of juniors in Civil Engineering and Civil Engineering Construction Option.

Mechanical properties of the following structural materials: Portland cement concrete, bituminous concrete, masonry materials and timber. Materials testing for research.

CE 338 Structures I 4 (3-3) f

Prerequisite: EM 211

Required of juniors in Architecture.

Analysis of simple structures, reactions, shear and moment diagrams; stresses in members of framed structures; graphic statics.

CE 339 Structures II 4 (3-3) s

Prerequisites: CE 338, EM 212

Required of juniors in Architecture.

Analysis of indeterminate structures; slopes and deflections; analysis of indeterminate frames by moment distribution.

CE 342 Soil Mechanics 4 (3-2) f s

Prerequisite: EM 301

Corequisite: CE 331

Required of juniors in Civil Engineering.

An introduction to the engineering behavior of soils. A study of physical and mechanical properties of soils, identification and classification, fundamental stress relations, ground water hydraulics, compressibility, shear strength, earth pressure theories, slope stability and bearing capacity. Laboratory periods divided among demonstration of soil testing, recitation and problem solving.

CE 361 Estimates and Costs I 3 (2-3) f

Prerequisite: Junior standing

Required of juniors in Civil Engineering Construction Option.

Interpretation of working drawings; analysis of construction plans and specifications; approximate and detailed estimates of costs.

CE 362 Estimates and Costs II 3 (2-3) s

Prerequisite: CE 361

Required of juniors in Civil Engineering Construction Option.

Preparation of complete costs estimates of construction projects; bidding procedures and preparation of bids.

CE 382 Hydraulics 3 (3-0) f s

Prerequisite: EM 303

Required of juniors in Civil Engineering.

Properties of fluids and mechanics of fluid flow in pipes and open channels; theory of design and characteristics of pumps and hydraulic motors; measurement of fluid flow.

COURSES FOR ADVANCED UNDERGRADUATES

CE 405, 406 Transportation Engineering I, II 4 (3-2)f s

Prerequisites: CE 201 for CE 405, CE 342 for CE 406

Required of seniors in Civil Engineering.

An integrated approach to the planning, design and operation of transportation systems. Engineering and economic aspects of the basic transport modes, including highway, rail, water and air facilities, are investigated from the viewpoint of the civil engineer.

CE 421 Structural Design I 3 (2-3) f

Prerequisites: CE 324, EM 301

Required of seniors in Civil Engineering and Civil Engineering Construction Option.

Basic design concepts. Analysis and design of tension, compression and flexural members in metal. Behavior and design of connections—riveted, bolted and welded. Term project in design of mill-building bent.

CE 422 Structural Design II 3 (2-3) s

Prerequisites: CE 332, CE 421, CE 425

Required of seniors in Civil Engineering.

Analysis and design, in reinforced concrete, of beams in flexure, diagonal tension, bond and anchorage; axially loaded columns, eccentrically loaded columns, footings, retaining walls, continuous beams and one-way slabs. Introduction to ultimate strength design. Term project in design of a multi-story building frame in reinforced concrete.

CE 425 Structural Analysis II 3 (2-3) f

Prerequisites: CE 324, EM 301

Required of seniors in Civil Engineering.

Deflection of beams and trusses; indeterminate stress analysis by moment area, slope deflection and moment distribution.

CE 429 Structural Design III 3 (2-3) s

Prerequisites: CE 332, CE 421

Required of seniors in Civil Engineering Construction Option.

Analysis and design of reinforced concrete beams, columns, footings and retaining walls. Design of timber beams, columns and connections. Term project in planning and making structural design for the timber forming needed for a reinforced concrete building.

CE 443 Foundations 3 (3-0) s

Prerequisite: CE 421

Required of seniors in Civil Engineering Construction Option.

Identification and classification of soils; geological aspects of foundation engineering; methods of investigating subsoil conditions; control of water; types of foundations and conditions favoring their use; legal concepts of foundation engineering.

CE 461 Project Planning and Control I 3 (2-3) f

Prerequisite: CE 362

Required of seniors in Civil Engineering Construction Option.

Analysis of construction plant layout requirements and performance characteristics of equipment.

CE 462 Project Planning and Control II 3 (2-3) s

Prerequisite: CE 461

Required of seniors in Civil Engineering Construction Option.

Scheduling, analysis and control of construction projects.

CE 464 Legal Aspects of Contracting 3 (3-0) s

Prerequisite: Senior standing

Required of seniors in Civil Engineering Construction Option.

Legal aspects of construction contract documents and specifications; owner-engineer-contractor relationships and responsibilities; bids and contract performance; labor laws.

CE 483 Water Resources Engineering I 3 (3-0) f

Prerequisite: CE 382

Required of seniors in Civil Engineering.

The hydrological cycle is studied with particular emphasis on those phases that are of engineering significance. The occurrence and distribution of water; rainfall, runoff, ground water. The development and control of water resources.

CE 484 Water Resources Engineering II 3 (3-0) s

Prerequisite: CE 483

Required of seniors in Civil Engineering.

A synthesis of mechanics, chemistry and hydrology in the design of elements of water resources systems. Water supply, treatment and distribution. Waste water collection, treatment and disposal. Consideration of flood control and stream flow regulation.

CE 485 Applied Hydraulics 3 (3-0) f

Prerequisite: EM 303

Required of seniors in Civil Engineering Construction Option.

Elements of fluid mechanics, hydraulics and hydrology, with application to problems in construction engineering.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

CE 507 Airphoto Analysis I 3 (2-3) f s

Prerequisite: Junior standing

Engineering evaluation of aerial photographs, including analysis of soils and surface drainage characteristics.

CE 508 Airphoto Analysis II 3 (2-3) s

Prerequisite: CE 507

Engineering evaluation of aerial photographs for highway and airport projects.

CE 514 Municipal Engineering Projects 3 (2-3) s

Prerequisite: Senior standing

Special problems relating to public works, public utilities, urban planning and city engineering.

CE 515 Transportation Operations 3 (3-0) f

Prerequisite: CE 406

The analysis of traffic and transportation engineering operations.

CE 516 Transportation Design 3 (2-3) s

Prerequisite: CE 406

The geometric elements of traffic and transportation engineering design.

CE 524 Analysis and Design of Masonry Structures 3 (3-0) f

Corequisite: CE 425

Analysis and design of arches, culverts, dams, foundations and retaining walls.

CE 525, 526 Advanced Structural Analysis I, II 3 (3-0) f s

Prerequisite: CE 425

Analysis of rigid frames and continuous structures; treatment of redundant members and secondary stresses.

CE 527 Numerical Methods in Structural Analysis 3 (3-0) s

Prerequisite: CE 425

Newmark's numerical integration procedure and its applications; matrix operations, relaxation and iteration, finite difference method. Force and displacement methods, string polygon method. High-speed computation.

CE 531 Experimental Stress Analysis 3 (2-3) f

Prerequisite: CE 425

Principles and methods of experimental analysis; dimensional analysis; applications to full-scale structures.

CE 534 Plastic Analysis and Design 3 (3-0) s

Prerequisite: CE 421

Analysis of steel structure behavior beyond the elastic limit; concept of design for ultimate load and the use of load factors. Analysis and design of component parts of frames. Methods of predicting strength and deformation behavior of structures loaded in the plastic range. Bracing and connection requirements for frames.

CE 535 Ultimate Strength Theory and Design 3 (3-0) f

Prerequisite: CE 422

Ultimate strength theories of axially loaded column flexure, combined flexure and axial load, shear. Critical review of important research and their relationship with the development of modern design codes for reinforced concrete.

CE 536 Theory and Design of Prestressed Concrete 3 (3-0) s

Prerequisite: CE 422

The principles of prestressed concrete. Materials. Methods of prestressing. Loss of prestress. Design of beams for bending, shear and bond. Ultimate strength. Deflection. Composite beams. Continuous beams. Special topics. Design projects.

CE 544 Foundation Engineering 3 (3-0) f s

Prerequisite: CE 342

Subsoil investigations; excavations; design of sheeting and bracing systems; control of water; footing, grillage and pile foundations; caisson and cofferdam methods of construction; legal aspects of foundation engineering.

CE 547 Fundamentals of Soil Mechanics 3 (3-0) f s

Prerequisite: EM 301

Physical and mechanical properties of soils governing their use for engineering purposes; stress relations and applications to a variety of fundamental problems.

CE 548 Engineering Properties of Soils I 3 (2-3) f

Prerequisite: CE 342

The study of soil properties that are significant in earthwork engineering, including properties of soil solids, basic clay mineral concepts, classification, identification, plasticity, permeability, capillarity and stabilization. Laboratory work includes classification, permeability and compaction tests.

CE 549 Engineering Properties of Soils II 3 (2-3) s

Prerequisite: CE 548

Continuation of CE 548, including the study of compressibility, stress-strain relations and shear strength theories for soil. Laboratory work includes consolidation and shear strength tests.

CE 570 Sanitary Microbiology 3 (2-3) f s

(See BO 570)

CE 571 Theory of Water and Sewage Treatment 3 (3-0) f

Prerequisite: Graduate standing

Study of the physical and chemical principles underlying water and sewage treatment processes; diffusion of gases, solubility, equilibrium and ionization, anaerobic and aerobic stabilization processes, sludge conditioning and disposal.

CE 572 Unit Operations and Processes in Sanitary Engineering 3 (1-6) s

Prerequisite: CE 571

Processes and operations in sanitary engineering; sedimentation, aeration, filtration, adsorption, coagulation, softening, sludge digestion, aerobic treatment of sewage.

CE 573 Analysis of Water and Sewage 3 (1-6) f

Corequisite: CE 571

Chemical and physical analysis of water and sewage and interpretation of results.

CE 574 Radioactive Waste Disposal 3 (2-3) f s

Prerequisite: PY 407

Unit operations and processes employed in treatment and disposal of radioactive wastes.

CE 580 Flow in Open Channels 3 (3-0) f s

Prerequisite: CE 483

The theory and applications of flow in open channels, including dimensional analysis, momentum-energy principle, gradually varied flow, high-velocity flow, energy dissipators, spillways, waves, channel transition and model studies.

CE 591, 592 Civil Engineering Seminar 1 (1-0) f s

Discussion and reports of subjects in civil engineering and allied fields.

CE 598 Civil Engineering Projects 1 to 6 arranged f s

Special projects in some phase of civil engineering.

COURSES FOR GRADUATES ONLY

CE 601 Transportation Planning 3 (3-0) s

Prerequisite: CE 515

The planning, administration, economics and financing of various transportation engineering facilities.

CE 602 Advanced Transportation Design 3 (2-3) s

Prerequisite: CE 516

Design of major traffic and transportation engineering projects.

CE 603 Airport Planning and Design 3 (2-3) f

Corequisite: CE 515

The analysis, planning and design of air transportation facilities.

CE 604 Urban Transportation Planning 3 (3-0) s

Prerequisite: CE 515

Thoroughfare planning as related to land usage and urban master-planning.

CE 623 Theory and Design of Arches 3 (3-0) f

Prerequisites: CE 422, CE 526

General theory of elastic arches. Boundary conditions and their effect on the behavior of the arch. Single span, multiple span arches on elastic piers, influence lines of various functions under moving loads, economical layout of arches, design criteria for steel and concrete arches.

CE 624 Analysis and Design of Structural Shells and Folded Plates 3 (3-0) s

Prerequisites: CE 623, EM 511

Roof structures consisting of surfaces of revolution, both single and compound curved. Membrane stresses, bending stresses at boundaries. Domes and cylindrical shells. Approximate and exact analyses. Design of criteria. Folded plane structures of concrete plates and steel frames.

CE 625, 626 Advanced Structural Design I, II 3 (2-3) f s

Prerequisite: CE 422

Corequisites: CE 525, CE 526

Complete structural designs of a variety of projects; principles of limit and prestress design.

CE 627 Design of Blast Resistant Structures 3 (3-0) f

Prerequisites: CE 526, EM 555

Sources, intensities, and methods of transmission of dynamic loads. Behavior of structures and structural elements subjected to dynamic forces. Design criteria and factor of safety. Design of surface and underground structures for nuclear blasts.

CE 641, 642 Advanced Soil Mechanics 3 (3-0) f s

Prerequisite: Graduate standing

Theories of soil mechanics; failure conditions; mechanical interaction between solids and water, and problems in elasticity pertaining to earthwork engineering; soil dynamics.

CE 643 Hydraulics of Ground Water 3 (3-0) f s

Prerequisite: Graduate standing

Principles of ground water hydraulics; theory of flow through idealized porous media; the flow net solution; seepage and well problems.

CE 671 Advanced Water Supply and Sewerage 4 (3-3) f

Prerequisite: CE 484

Problems relating to the design of water supply and sewerage works.

CE 672 Advanced Water and Sewage Treatment 4 (3-3) s

Prerequisite: CE 484

Problems relating to the treatment of water and sewage.

CE 673 Industrial Water Supply and Waste Disposal 3 (3-0) f s

Corequisite: CE 571

Water requirements of industry and the disposal of industrial wastes.

CE 674 Stream Sanitation 3 (3-0) f s

Corequisite: CE 571

Biological, chemical and hydrological factors that affect stream sanitation and stream use.

CE 699 Civil Engineering Research 1 to 6 arranged f s

Independent investigation of an advanced civil engineering problem; a report of such an investigation is required as a graduate thesis.

CROP SCIENCE

COURSES FOR UNDERGRADUATES

CS 211 Crop Science I 3 (3-0) f s

Discussion of fundamental principles underlying field crop production with emphasis on the applications of plant sciences. Varieties, crop characteristics, environmental factors, rotations, pests, and other production practices associated with the major and minor field crops will be included.
Mr. Lewis

CS 311 Field Crops II 3 (2-2) f

Prerequisites: CS 211, SSC 200

Specific problems in field crop production other than forage crops. Discussion of those crops in farm rotations brings together all the major aspects of crop production for different climatic areas. Mr. Lewis

CS 312 Pastures and Forage Crops 3 (3-0) s

Prerequisites: BS 100, SSC 200 recommended

A study of the production and preservation of the principal forage crops. Special attention is given to the development and maintenance of pastures.
Mr. Chamblee

CS 315 Turf Management 3 (2-2) s

Prerequisite: BS 100

Basic principles of turf production and their practical application to establishment, maintenance, renovation, and pest control on lawns, playgrounds, sports fields, road areas, and similar specialized turf areas.
Mr. Gilbert

CS 413 Plant Breeding 3 (3-0) s

Prerequisite: GN 411

The application of genetic principles to the improvement of economic plants, including discussions of the methods employed in the development and the perpetuation of desirable clones, varieties, and hybrids.
Mr. Emery

CS 414 Weeds and Their Control 3 (2-2) f

Prerequisite: CH 220 or equivalent

Principles involved in cultural and chemical weed control. Discussions on chemistry of herbicides and the effects of the chemicals on the plant. Identification of common weeds and their seeds is given. Mr. Klingman

CS 490 Senior Seminar 1 (1-0) s

Prerequisite: Senior standing

The collection, organization, written preparation, and oral delivery of scientific information concerning topics of interest in Crop Science.
Mr. Harvey

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

CS 511 Tobacco Technology 2 (2-0) s

Prerequisites: CS 311, BO 421 or equivalent

A study of special problems concerned with the tobacco crop. The latest research problems and findings dealing with this important cash crop will be discussed. Mr. Jones

CS 512 GRASSLAND DYNAMICS 2 (2-0) s

Prerequisites: BO 421, ZO 421 or equivalent

A discussion of forage production practices of national and international importance. An attempt will be made to relate the seemingly divergent practices to fundamentals of physiology and ecology. The dynamic relationship among soil, plant, animal and man, as it affects forage production practices and research, will be emphasized.
(Offered 1964-65 and alternate years.) Mr. Gross

CS 541 (GN 541 or HS 541) PLANT BREEDING METHODS 3 (3-0) f

Prerequisites: GN 512, ST 511 recommended

An advanced study of methods of plant breeding as related to principles and concepts of inheritance. Messrs. Haynes, Timothy

CS 542 (GN 542 or HS 542) PLANT BREEDING FIELD PROCEDURES 2 (0-4) summer

Prerequisite: CS 541 or GN 541 or HS 541

Laboratory and field study of the application of the various plant breeding techniques and methods used in the improvement of economic plants. Mr. Harvey

CS 591 SPECIAL PROBLEMS credits by arrangement

Prerequisite: Consent of instructor

Special problems in various phases of Crop Science. Problems may be selected or will be assigned. Emphasis will be placed on review of recent and current research. Graduate Staff

COURSES FOR GRADUATES ONLY

Students are to consult the instructor before registration.

CS 611 FORAGE CROP ECOLOGY 2 (2-0) s

Prerequisites: CS 512, BO 442

A study of the effect of environmental factors on the growth of forage crops. Attention will be given to methods of research in forage ecology. Mr. Chamblee

CS 612 SPECIAL TOPICS IN WEED CONTROL 2 (2-0) s

Prerequisites or corequisites: CS 414, CH 223, BO 534

Detailed examination of current concepts and literature of weed control. The chemistry, physiology, ecology, taxonomy, microbiology, equipment, and techniques used in weed control research will be discussed. Graduate Staff

CS 613 (GN 613 or HS 613) PLANT BREEDING THEORY 3 (3-0) s

Prerequisites: CS 541 or equivalent, GN 513, ST 512, a course in Quantitative Genetics recommended

A study of theoretical bases for plant breeding procedures with special emphasis on the relationship between type and source of genetic variability, mode of reproduction, and effectiveness of different selection procedures. The latest experimental approaches to plant breeding will be discussed as well as standard procedures. Messrs. Dudley, Miller

CS 690 SEMINAR 1 (1-0) f s

Prerequisite: Graduate standing

Scientific articles, progress reports in research, and special problems of interest to agronomists reviewed and discussed. A maximum of two credits is allowed toward the masters degree; however, additional credits towards the doctorate are allowed. Graduate Staff

CS 699 RESEARCH credits by arrangement

Prerequisite: Graduate standing

A maximum of six credits is allowed toward the masters degree, but no restrictions toward the doctorate. Graduate Staff

DESIGN

DN 101, 102 DESIGN I, II 4 (2-9) f s

Corequisites: DN 111, DN 121, and DN 112, DN 122

Introduction to the elements and expression of two and three dimensional design involving a variety of tools, materials, and techniques. Orientation of historical and contemporary concepts of art, architecture, and technology. Messrs. Bireline, Flynn, Hertzman, Musselwhite, Stuart, Taylor

DN 111, 112 DESCRIPTIVE DRAWING I, II 2 (1-2) f s

Corequisites: DN 101, DN 121, and DN 102, DN 122

Problems in visual analysis with emphasis on the systems man has devised to describe his visual experience.

Messrs. Bireline, Flynn, Hix, Musselwhite, Taylor

DN 121, 122 TECHNICAL DRAWING I, II 2 (1-2) f s

Corequisites: DN 101, DN 111, and DN 102, DN 112

Descriptive geometry and allied technical drawing. Lectures and simple exercises in analytical programming of architectural elements.

Messrs. Hix, Shogren

DN 211, 212 DESCRIPTIVE DRAWING III, IV 2 (0-6) f s

Problems continuing the studies begun in freshman year with the addition of the study of color and its effects.

Messrs. Flynn, Hertzman, Nichols, Taylor

DN 311, 312 ADVANCED DESCRIPTIVE DRAWING I, II 2 (0-6) f s

Prerequisite: DN 212

Extension of problems introduced in first and second year drawing on a more advanced level. Problems will involve the human figure and its environment and investigate techniques to increase the ability of the student to express his ideas in varied forms.

Messrs. Eichenberger, Stuart, Taylor

DN 321, 322 HISTORY OF DESIGN I, II 3 (3-0) f s

Prerequisite: HI 245

A critical study of architecture from prehistoric times to the present including references to landscape architecture, painting, sculpture, and artifacts. Mr. Wodehouse

DN 411, 412 ADVANCED DESCRIPTIVE DRAWING III, IV 2 (0-6) f s

Prerequisite: DN 312

Advanced problems in the field of painting, sculpture, graphics, and photography. Messrs. Bireline, Cox, Musselwhite, Shawcroft

DN 421, 422 HISTORY OF DESIGN III, IV 3 (3-0) f s

Prerequisite: HI 246

Specialized historical studies in design fields.

Messrs. Clarke, Harris

DN 511, 512 Advanced Descriptive Drawing V, VI 2 (0-6) f s

Prerequisite: DN 412

Advanced problems in the fields of painting, sculpture, photography, and graphics. Messrs. Bireline, Cox, Musselwhite, Shawcroft

DN 541 Seminar on Ideas in Design 2 (2-0) f

Corequisites: ARC 501, LAR 501, or PD 501

Required of fifth year students in the School of Design

An introduction to aesthetics and the relationships of philosophic thought to design. Mr. Kamphoefner

ECONOMICS

COURSES FOR UNDERGRADUATES

EC 201, 202 Economics 3 (3-0) f s

Fundamental principles applying to the organization and functioning of our economy.

EC 205 The Economic Process 3 (3-0) f s

An analysis of the process and principles by which an economy allocates resources, distributes goods and income and determines rate of growth.

EC 301 Production and Prices 3 (3-0) f or s

Prerequisite: EC 202 or EC 205

An intensive study of the functioning of the market economy. An examination of the role of prices in determining the allocation of resources, the functioning of the firm in the economy, and forces governing the production of economic goods.

EC 302 National Income and Economic Welfare 3 (3-0) f or s

Prerequisite: EC 201 or EC 205

An intensive examination of factors determining the national income. The economic and social effects of the level, composition, and distribution of national income will be studied with reference to theories of economic welfare and to public policy.

EC 310 Economics of the Firm 3 (3-0) s

Prerequisite: EC 201 or EC 205

An examination of the economic setting within which the business firm makes decisions, and an application of economic analysis to these decisions. Economics from the focal point of managerial decision-making.

EC 312 Accounting I 3 (3-0) f s

Introductory and problem materials designed to provide an understanding of accounting data, its accumulation and measurements as a tool of applied economics and its employment by management. This course deals with concepts and tools of analysis necessary for the selection, quantification and communication of business transactions through the accounting process. Individual ownerships, partnerships, and corporations are studied, with emphasis on the corporate form of organization.

EC 313 Accounting II 3 (3-0) f s

Prerequisite: One semester of Accounting

A second semester course in accounting with emphasis on managerial use in decision-making. Concepts and methods pertinent to the accumu-

lation, organization, and interpretation of data useful in evaluating, planning and controlling the performances of the business enterprise.

EC 317 Introduction to Methods of Economic Analysis 3 (3-0) f s
Prerequisite: EC 301

This course treats the fundamentals of quantitative methods and economic models in the application to economic and industrial problems. Through the study of economic variables and their parameters it lays the groundwork for later study of firm and consumer behavior. Analysis of the supply and demand sides of the market equation is emphasized. There is further examination of the economic structure from the standpoint of multiple markets and the general economy.

EC 407 Business Law I 3 (3-0) f s
Prerequisite: Basic courses in Economics

A course dealing with elementary legal concepts, contracts, agency, negotiable instruments, sales of personal property and insurance. Uniform commercial code considered under all titles applicable.

EC 408 Business Law II 3 (3-0) f s
Prerequisite: EC 407

Deals with real property, bailments, partnerships, corporations, chattel mortgages, mortgages on real estate, landlord and tenant, insurance, wills, suretyship, conditional sales, and bankruptcy. Uniform commercial code considered under all titles applicable.

EC 409 Introduction to Production Cost 3 (3-0) f s
Prerequisite: EC 312

An introduction to accounting for manufacturing, fabrication and construction-type enterprises. The determination and allocation of costs of materials, labor, and overhead. Special emphasis is placed on managerial analysis, interpretation, and control of cost data.

EC 410 Industry Studies 3 (3-0) f
Prerequisite: EC 201 or EC 205

An analysis of organization, market structure, and competitive behavior in the general economy, using the tools of the economist as a guide to pertinent factors and their significance.

EC 411 Marketing Methods 3 (3-0) f s
Prerequisite: Basic courses in Economics

Marketing institutions and their functions and agencies; retailing; market analysis; problems in marketing.

EC 413 Competition, Monopoly, and Public Policy 3 (3-0) s
Prerequisite: EC 201 or EC 205, EC 301

An analysis of the effect of modern industrial structure on competitive behavior and performance, in the light of contemporary price theory and the theory of workable competition. A critical evaluation of the legislative content, judicial interpretation, and economic effects of the anti-trust laws.

EC 414 Tax Accounting 3 (2-2) f s
Prerequisite: EC 312

An analysis of the federal tax laws relating to the individual and business. Determining and reporting income. Payroll taxes and methods of reporting them. Actual practice in the preparation of income tax returns.

EC 417 Introduction to Economic Dynamics 3 (3-0) f s

Prerequisites: EC 301, EC 302

The course has a twofold purpose: 1) to acquaint the student with the procedures and problems involved in the formulation and application of theories and models in economics, and 2) to investigate some existing theories and models, drawn from various parts of economics, which possess dynamic properties.

EC 420 Corporation Finance 3 (3-0) f s

Prerequisite: EC 201 or EC 205

Financial instruments and capital structure; procuring funds; managing working capital; managing corporate capitalization; financial institutions and their work.

EC 425 Industrial Management 3 (3-0) f

Prerequisite: Junior standing

Principles and techniques of modern scientific management; relation of finance, marketing, industrial relations, accounting, and statistics to production planning and control; analysis of economic, political and social influences on production.

EC 426 Personnel Management 3 (3-0) s

Prerequisite: Junior standing

The scientific management of manpower, from the viewpoint of the supervisor and the personnel specialists. A study of personnel policy and a review of the scientific techniques regarding the specific problems of employment, training, promotion, transfer, health and safety, employee service, and joint relations.

EC 431 Labor Problems 3 (3-0) f s

Prerequisite: Junior standing

An economic approach to labor problems including wages, hours, working conditions, insecurity, substandard workers, minority groups, social security, and public policy relative to these problems.

EC 432 Industrial Relations 3 (3-0) f s

Prerequisite: Junior standing

Collective bargaining. Analysis of basic labor law and its interpretation by the courts and governmental agencies. An examination of specific terms of labor contracts and their implications for labor and management. An examination of labor objectives and tactics and management objectives and tactics. Problems of operating under the labor contract.

EC 440 Economics of Growth 3 (3-0) s

Prerequisite: EC 201 or EC 205

An examination of the institutional background required for national economic development. The conditions apparent for past growth of nations are compared with conditions obtained in presently retarded nations. Conclusions are drawn from this comparison to provide an introduction to the theoretical models of growth.

EC 442 Evolution of Economic Ideas 3 (3-0) f or s

Prerequisite: Basic courses in Economics

An analysis of the development of economic thought and method during the past two centuries. Economics as a cumulative body of knowledge in a context of emerging technology, changing institutions, pressing new problems, and the growth of science.

EC 446 Economic Forecasting 3 (3-0) f or s

Prerequisites: EC 201 or EC 205. EC 302 recommended but not required

An examination of the basic principles and techniques of economics forecasting with strong emphasis upon the economic models upon which forecasting is based.

EC 448 International Economics 3 (3-0) f

Prerequisite: EC 201 or EC 205

A study of international economics, including trade, investment, monetary relations, and certain aspects of economic development. Emphasis upon analytical and policy approaches, although some institutional material is included.

EC 450 Economic Decision Processes 3 (3-0) s

Prerequisites: EC 201 or EC 205, MA 202 or MA 212

An analysis of processes for decision making by individuals and groups. Linear programming, probability, and game theory in the light of a general theory of decision.

EC 490, 491 Senior Seminars in Economics 3 (3-0) f s

Prerequisite: Consent of instructor

Terminal courses in undergraduate study of economics. The student is assisted in summarizing his training, and in improving his capacity to recognize problems and to select logically consistent means of solving the problems. This is done on a small-group and individual basis.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

EC 501 Intermediate Economic Theory 3 (3-0) f

Prerequisite: EC 301 or AGC 212 or equivalent

An intensive analysis of the determination of prices and of market behavior including demand, costs and production, pricing under competitive conditions, and pricing under monopoly and other imperfectly competitive conditions.

EC 502 Money, Income and Employment 3 (3-0) s

Prerequisite: EC 302 or EC 501 or equivalent

A study of the methods and concepts of national income analysis with particular reference to the role of monetary policy in maintaining full employment without inflation.

EC 510 (PS 510) Public Finance 3 (3-0) f s

Prerequisite: EC 201 or EC 205

A survey of the theories and practices of governmental taxing, spending, and borrowing, including intergovernmental relationships and administrative practices and problems.

EC 525 Management Policy and Decision Making 3 (3-0) f

Prerequisites: Nine hours in Economics and related courses and consent of instructor

A review and consideration of modern management processes used in making top-level policies and decisions. An evaluation of economic, social and institutional pressures, and of the economic and non-economic motivations, which impinge upon the individual and the organization. The problem of coordinating the objectives and the mechanics of management is examined.

EC 531 Management of Industrial Relations 3 (3-0) s

Prerequisites: Senior standing and consent of instructor

A seminar course designed to round out the technical student's program. Includes a survey of the labor movement organization and structure of unions, labor law and public policy, the union contract and bargaining process, and current trends and tendencies in the field of collective bargaining.

EC 541 Origins of The United States' Economy 3 (3-0) f

Prerequisites: Senior or Graduate standing; EC 205, HI 261 or HI 333, or equivalents

A seminar on growth and development of American economic institutions. Emphasis is placed on the relationship between the growth of the economy of the United States and theories of economic development.

EC 550 Mathematical Models in Economics 3 (3-0) f or s

Prerequisites: EC 201 or EC 205, MA 202 or MA 212, EC 450 recommended but not required

An introductory study of economic models emphasizing their formal properties. The theory of individual economic units is presented as a special case in the theory of inductive behavior. Mathematical discussions of the theory of the consumer, the theory of the firm, and welfare economics will show the relevance of such topics as constrained maxima and minima, set theory, partially and simply ordered systems, probability theory, and game theory to economics.

EC 552 Econometrics 3 (3-0) f or s

Prerequisites: EC 201 or EC 205, MA 202 or MA 212, ST 361

An analysis of methods for economic inference. Multi-equation economic models; their specification, identification, and estimation.

EC 555 Linear Programming 3 (3-0) f s

Prerequisites: EC 201, or EC 205, MA 202 or MA 212, MA 405

Recent developments in the theory of production, allocation, and organization. Optimal combination of integrated productive processes within the firm. Applications in the economics of industry and of agriculture.

EC 590, 591 Seminars in Special Economic Topics 3 (3-0) f s

Prerequisite: Consent of instructor

Topics presented by a visiting professor or special lecturer. This course will be offered from time to time as distinguished visiting scholars are available.

COURSES FOR GRADUATES ONLY

EC 601 Advanced Economic Theory 3 (3-0) f s

Prerequisite: EC 501 or equivalent

A rigorous examination of contemporary microeconomic theory.

EC 602 (AGC 602) Monetary and Employment Theory 3 (3-0) f s

Prerequisite: EC 502 or equivalent

The course consists of an analysis of the forces determining the level of income and employment; a review of some of the theories of economic fluctuations; and a critical examination of a selected macroeconomic system.

EC 603 History of Economic Thought 3 (3-0) f

Prerequisites: EC 442 or EC 501, EC 502 or equivalent

A systematic analysis of the development and cumulation of economic

thought, designed in part to provide a sharper focus and more adequate perspective for the understanding of contemporary economics.

EC 640 Theory of Economic Growth 3 (3-0) f s

Prerequisite: EC 440 or EC 502 or equivalent

Several theoretical models of economic growth are compared and analyzed. Contemporary developments in the theory of national economic growth are studied and evaluated for consistency with older theories.

EC 648 Theory of International Trade 3 (3-0) s

Prerequisite: EC 448 or EC 501 or equivalent

A consideration, on a seminar basis, of the specialized body of economic theory dealing with the international movement of goods, services, capital, and payments. Also, a theoretically-oriented consideration of policy.

EC 650 Economic Decision Theory 3 (3-0) f or s

Prerequisites: EC 501 or equivalent, EC 550 or EC 555

Study of general theories of choice. Structure of decision problems; the role of information; formulation of objectives. Current research problems.

EC 655 Topics in Mathematical Economics 3 (3-0) f s

Prerequisites: EC 501 or equivalent, EC 550 or EC 555

A seminar and research course devoted to recent literature and developments in mathematical economics.

EC 665 Economic Behavior of the Organization 3 (3-0) s

Prerequisites: EC 501 or equivalent, consent of instructor

This seminar will apply methods and findings derived from the behavioral sciences to the economic behavior of the organization, particularly the business firm. Among the approaches which may be utilized are organization theory, information theory, reference group theory, and decision theory.

EC 699 Research in Economics credits by arrangment

Prerequisite: Graduate standing

Individual research in economics, under staff supervision and direction.

EDUCATION

COURSES FOR UNDERGRADUATES

ED 100 Introduction to Industrial Education 2 (2-0) f

(For description, see Industrial Education, page 343)

ED 102 Objectives in Agricultural Education 1 (1-0) f s

(For description, see Agricultural Education, page 245)

ED 203 Introduction to Teaching Mathematics and Science 2 (2-0) s

(For description, see Mathematics and Science Education, page 361)

ED 304 (PHI 304) Philosophy of Education 3 (3-0) f s

Implications of various philosophical viewpoints, especially in value theory, social-political philosophy, and theory of knowledge, for the aims and procedures of education; study of relevant work of the principal contributors to the Western intellectual tradition from Plato to the present.

Mr. Hicks

ED 305 Analysis of Technical Education Programs and Course Construction 3 (3-0) s

(For description, see Industrial Education, page 343)

ED 308 Visual Aids 2 (1-2) s

Methods and techniques of visual instruction; lettering; statistical illustration; chart, graph and poster-making; photography, projector operation, care and use.

Staff

ED 313 Teaching Rural People 2 (2-0) f s

(For description, see Agricultural Education, page 246)

ED 327 History and Philosophy of Industrial Technical Education 3 (3-0) f

(For description, see Industrial Education, page 343)

ED 344 Secondary Education 3 (3-0) f s

An overview of secondary education, including development, problems, services, trends, teaching profession, role of school in the community; purposes and objectives; the development and status of secondary education in North Carolina.

Messrs. Anderson, Shannon

ED 405 Industrial and Technical Education Shop and Laboratory Planning 3 (3-0) f

(For description, see Industrial Education, page 343)

ED 410 Driver Education 3 (2-2) f s

The principles of teaching basic driving skills, including the new concept of defensive driving, observance and interpretation of motor vehicle laws, adverse driving conditions, handling of accident situations and care of the car.

Mr. Crawford

ED 411 Student Teaching in Agriculture 6 (3-12) f s

(For description, see Agricultural Education, page 246)

ED 412 Teaching Adults 2 (1-2) f s

(For description, see Agricultural Education, page 246)

ED 413 Planning Educational Programs 2 (1-2) f s

(For description, see Agricultural Education, page 246)

ED 418 (SOC 418) (RS 418) Educational Sociology 3 (3-0) f s

Prerequisite: Three hours in Sociology

An investigation of the educational institution in a sociological framework. Analyzes the school as a social system, roles of the functionaries of education, relationships within the student body, effects of social factors upon the learning experience, reciprocal school-community relationships, adult education, and higher education in American society.

Mr. Drabick

ED 420 Principles of Guidance 2 (2-0) f s

(For description, see Occupational Information and Guidance, page 383)

ED 422 Methods of Teaching Industrial Subjects 3-4 credits s

(For description, see Industrial Arts and Industrial Education, pages 340 and 343)

ED 440 Vocational Education 2 (2-0) f

(For description, see Industrial Education, page 343)

ED 444 Student Teaching in Industrial Subjects 6 (2-15) f

(For description, see Industrial Arts and Industrial Education, pages 341 and 343)

ED 450 Methods and Materials in Teaching English 3 (3-0) s

Prerequisites: PSY 304, ED 344, Senior standing and admission to Teacher Education with a major in English and an over-all 2.0 average

A study of the purposes, curricula, materials and methods of teaching the skills of reading, writing, speaking and listening in secondary schools.

Staff

ED 454 Student Teaching in English 6 (2-15) s

Prerequisites: PSY 304, ED 344, Senior standing and admission to Teacher Education with a major in English and an over-all 2.0 average

This course is designed to provide the prospective teacher with an opportunity to acquire experience in the techniques and skills involved in teaching English. Each student during the senior year will spend ten weeks in a selected off-campus center. In addition to acquiring the competencies essential for teaching English, the student teacher will also have an opportunity to become familiar with the total school program and to participate in as many school and community activities as time will permit during the period of student teaching.

Staff

ED 460 Methods and Materials in Teaching Social Studies 3 (3-0) s

Prerequisites: PSY 304, ED 344, Senior standing and admission to Teacher Education with a major in Social Studies and an over-all 2.0 average

A study of the purposes, methods, materials, curricula, and evaluation practices appropriate for teachers of Social Studies at the secondary level.

Staff

ED 462 (HI 462) History of Education 3 (3-0) s

Prerequisite: Three hours of History or departmental approval

The course traces the development of educational institutions and practices and analyzes the ideas and influence of educational innovators and critics. Approximately equal time is given to each of the following units: The Greeks to the Reformation, Modern Europe, and the United States.

Mr. Noblin

ED 464 Student Teaching in Social Studies 6 (2-15) s

Prerequisites: PSY 304, ED 344, Senior standing and admission to Teacher Education with a major in Social Studies and an over-all 2.0 average.

This course is designed to provide the prospective teacher with an opportunity to acquire experience in the techniques and skills involved in teaching Social Studies. Each student during the senior year will spend ten weeks in a selected off-campus center. In addition to acquiring the competencies essential for teaching Social Studies, the student teacher will also have an opportunity to become familiar with the total school program and to participate in as many school and community activities as time will permit during the period of student teaching.

Staff

ED 470 Methods of Teaching Mathematics 3 (3-0) f

(For description, see Mathematics and Science Education, page 361)

ED 471 Student Teaching in Mathematics 6 (2-15) f s

(For description, see Mathematics and Science Education, page 361)

ED 472 Developing and Selecting Teaching Materials in Mathematics 2 (2-0) f s

(For description, see Mathematics and Science Education, page 361)

ED 475 Methods of Teaching Science 3 (3-0) f s
(For description, see Mathematics and Science Education, page 361)

ED 476 Student Teaching in Science 6 (2-15) f s
(For description, see Mathematics and Science Education, page 361)

ED 477 Developing and Selecting Teaching Materials in Science 2 (2-0) f s
(For description, see Mathematics and Science Education, page 361)

ED 482 Curriculum Problems in Industrial Arts 2 (1-2) f
(For description, see Industrial Arts, page 341)

ED 483 Instructional Aids and Devices 2 (1-2) f
(For description, see Industrial Arts and Industrial Education, pages 341 and 344)

ED 490 Senior Seminar 1 (1-0) f s
(For description, see Agricultural Education, page 246)

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 501 Education of Exceptional Children 3 (2-2) f
Discussion of principles and techniques of teaching the exceptional child with major interest on the mentally handicapped and slow learner.
Practice will be given in curriculum instruction for groups of children, and individual techniques for dealing with retarded children in the average classroom. Opportunity for individual work with an exceptional child will be provided. Mr. Corter

ED 502 Analysis of Reading Abilities 3 (3-0) f
Prerequisites: Six hours in Education or Psychology
A study of tests and techniques in determining specific abilities; a study of reading retardation and factors underlying reading difficulties.
Mr. Rust

ED 503 Improvement of Reading Abilities 3 (3-0) s
Prerequisites: Six hours in Education or Psychology
A study of methods used in developing specific reading skills or in overcoming certain reading difficulties; a study of methods used in developing pupil vocabularies and word analysis skills; a study of how to control vocabulary burden of reading material. Mr. Rust

ED 516 Community Occupational Surveys 2 (2-0) s
(For description, see Industrial Education, page 344)

ED 520 Personnel and Guidance Services 3 (3-0) f
(For description, see Occupational Information and Guidance, page 383)

ED 521 Organization of Related Study Materials 3 (3-0) f s
(For description, see Industrial Education, page 344)

ED 524 Occupational Information 3 (3-0) s
(For description, see Occupational Information and Guidance, page 383)

ED 525 Trade Analysis and Course Construction 3 (3-0) f
(For description, see Industrial Education, page 344)

ED 527 Philosophy of Industrial and Technical Education 3 (3-0) f s
(For description, see Industrial Education, page 344)

ED 528 Principles and Practices in Industrial Cooperative Training 3 (3-0) f s

(For description, see Industrial Education, page 344)

ED 529 Curriculum Materials Development 3 (3-0) s

(For description, see Industrial Education, page 344)

ED 530 Group Guidance 3 (3-0) f

(For description, see Occupational Information and Guidance, page 383)

ED 533 Organization and Administration of Guidance Services 3 (3-0) s

(For description, see Occupational Information and Guidance, page 383)

ED 552 Industrial Arts in the Elementary School 3 summer

Prerequisites: Twelve credits in Education and consent of instructor

This course is organized to help elementary teachers and principals understand how tools and materials and industrial processes may be used to vitalize and supplement the elementary school childen's experiences. Practical children's projects along with the building of classroom equipment.

Mr. Hostetler

ED 554 Planning Programs in Agricultural Education 3 (3-0) f s

(For description, see Agricultural Education, page 246)

ED 560 (IA 560) New Development in Industrial Arts Education 3 (3-0) f or s

(For description, see Industrial Arts, page 342)

ED 563 Effective Teaching 3 (3-0) f s

Prerequisite: 12 hours in Education including Student Teaching

Analysis of the teaching-learning process; assumptions that underlie course approaches; identifying problems of importance; problem solution for effective learning; evaluation of teaching and learning; making specific plans for effective teaching. Mr. Scarborough

ED 568 Adult Education in Agriculture 3 (3-0) f s

(For description, see Agricultural Education, page 246)

ED 590 Individual Problems in Guidance maximum 6

(For description, see Occupational Information and Guidance, page 384)

ED 591 Special Problems in Industrial Education maximum 6

(For description, see Industrial Education, page 344)

ED 592 Special Problems in Mathematics Teaching 3 (3-0) s

(For description, see Mathematics and Science Education, page 362)

ED 593 Special Problems maximum 6

(For description, see Agricultural Education, page 246)

ED 594 Special Problems in Science Teaching 3 (3-0) s

(For description, see Mathematics and Science Education, page 362)

ED 595 (IA 595) Industrial Arts Workshop 3 summer

(For description, see Industrial Arts, page 342)

COURSES FOR GRADUATES ONLY

ED 609 Planning and Organizing Technical Education Programs — 3 (3-0) f

(For description, see Industrial Education, page 345)

ED 610 Administration and Supervision of Vocational Education — 3 (3-0) s

(For description, see Industrial Education, page 345)

ED 614 Modern Principles and Practices in Secondary Education — 2 (2-0) f s

Prerequisites: Twelve hours in Education

Foundations of modern programs of secondary education; purposes, curriculum, organization, administration, and the place and importance of the high school in the community in relation to contemporary social force.

Graduate Staff

ED 615 Introduction to Educational Research — 3 (3-0) f s

Prerequisites: Twelve hours in Education, PSY 535 or equivalent

An introductory course for students preparing for an advanced degree. The purposes are to assist the student in understanding the meaning and purpose of educational research and the research approach to problems; to develop students' ability to identify educational problems, and to plan and carry out research to solve these problems; to aid in the preparation of the research report. Special attention is given to tools and methods of research. Consideration is also given to the educator as a consumer of research.

Mr. Chansky

ED 617 Philosophy of Agricultural Education — 3 (3-0) f s

(For description, see Agricultural Education, page 247)

ED 630 Philosophy of Industrial Arts — 2 (2-0) f s

(For description, see Industrial Arts, page 342)

ED 631 Educational and Vocational Guidance — 3 (3-0) f

(For description, see Occupational Information and Guidance, page 384)

ED 633 Techniques of Counseling — 3 (3-0) s

(Same as one above)

ED 635 Administration and Supervision of Industrial Arts — 2 (2-0) f s

(For description, see Industrial Arts, page 342)

ED 641 Laboratory and Practicum Experiences in Counseling — 2-6 credits f s

(For description, see Occupational Information and Guidance, page 384)

ED 664 Supervision in Agricultural Education — 3 (3-0) f s

(For description, see Agricultural Education, page 247)

ED 665 Supervising Student Teaching — 3 (3-0) f s

Prerequisite: Twelve hours in Education

A study of the program of student teaching in teacher education. Special consideration will be given the role of the supervising teacher including the following areas: planning for effective student teaching, observation and orientation, school community study, analysis of situation, evaluating student teachers, and coordination with North Carolina State.

Graduate Staff

ED 690 Seminar in Mathematics Education maximum 2
(For description, see Mathematics and Science Education, page 362)

ED 691 Seminar in Industrial Education maximum 2
(For description, see Industrial Education, page 344)

ED 692 Seminar in Industrial Arts Education 1 (1-0) f s
(For description, see Industrial Arts, page 342)

ED 693 Advanced Problems maximum 6
(For description, see Agricultural Education, page 247)

ED 694 Seminar in Agricultural Education maximum 2
(For description, see Agricultural Education, page 247)

ED 695 Seminar in Science Education maximum 2
(For description, see Mathematics and Science Education, page 362)

ED 699 Research maximum 6
Prerequisites: Fifteen credits and permission of advisor
Individual research on a specific problem of concern to the student.
Graduate Staff

ELECTRICAL ENGINEERING

COURSES FOR UNDERGRADUATES

EE 201 Elementary Circuits and Fields 4 (2-5) f s
Prerequisite: MA 102
Required of sophomores in Electrical Engineering.
Fundamental laws of electric circuits. Introduction to transient and steady-state analysis. Problem drill and laboratory exercises. Staff

EE 202 Elementary Circuits and Fields 4 (2-5) s
Prerequisites: EE 201, MA 201
Required of sophomores in Electrical Engineering.
A continuation of EE 201. Introduction to magnetic circuits, magnetic and electric fields, energy conversion and two-port active elements. Problem drill and laboratory exercises. Mr. Seagraves

EE 301, 302 Intermediate Circuits and Fields 4 (2-5) f s
Prerequisites: EE 202, MA 202
Required of juniors in Electrical Engineering.
An intermediate treatment of lumped-constant alternating-current circuits in the steady state. Single- and three-phase circuits. Discussion of electric and magnetic fields, distributed constants, and traveling waves. The theory of transmission lines at power and audio frequencies. Filters and impedance matching. One three-hour laboratory per week is included.
Staff

EE 305 Electrical Machinery 4 (2-5) f
Prerequisite: EE 202, MA 202
Required of juniors in Electrical Engineering.
A classroom and laboratory study of the principles, performance, and characteristics of direct-current and alternating-current machinery.
Mr. Goetze

EE 306 Electrical Machinery 4 (3-3) s

Prerequisites: EE 301, EE 305, MA 301

A continuation of EE 305 into more advanced phases of the theory of alternating and direct-current machinery Mr. Goetze

EE 310 Illumination 3 (2-3) s

Prerequisite: EE 301 or EE 320 or EE 331

A study of the principles involved in the production and utilization of light from artificial sources; of the requirements for good lighting; and of the design of lighting installations for schools and industry. Mr. Winkler

EE 314 Electronics 4 (2-5) s

Prerequisites: EE 301, MA 301

A study of active vacuum, gas, and solid state devices as elements of electric circuits. Analysis is made of linear and non-linear representation and operation. Mr. Manning

EE 320 Elements of Electrical Engineering 4 (3-3) f s

Prerequisites: MA 201, PY 202

Alternate for EE 331 for students in CE, CEC, MIG.
Alternate for EE 350 for students in Engineering Operations.

Principles, characteristics, and operation of electric equipment and systems. Theory and problems in applied electricity, motor characteristics, industrial applications, and electronics. Mr. Smiley

EE 331 Principles of Electrical Engineering 4 (3-3) f s

Prerequisites: MA 301, PY 202

Required of seniors in Industrial Engineering and Mechanical Engineering.

Basic concepts, electrical power generation and utilization, circuit elements, single and polyphase a.c. circuits, transformers, rotating electrical machines. Fundamentals of electronics and control circuits. Staff

EE 332 Principles of Electrical Engineering 4 (3-3) s

Prerequisite: EE 331

A continuation of EE 331.

EE 350 Electric Power Utilization in Manufacturing Processes 3 (2-3) f s

Prerequisites: PY 212, MA 201

Introduction to basic electrical theory; d-c and a-c circuits and measurements; study of d-c motors and of single-phase and polyphase utilization equipment; basic control systems and brief introduction to principles of automatic control. Application examples will be drawn from the technologies of particular interest to the students in the class. Mr. Winkler

COURSES FOR ADVANCED UNDERGRADUATES

EE 401 Advanced Circuits and Fields I 3 (2-2) f

Prerequisites: EE 302, MA 301

Required of seniors in Electrical Engineering.

Transient analysis of electric circuits by the Laplace transform method, the study of transient and sinusoidal steady-state response in terms of poles and zeros of network functions. Mr. Stevenson

EE 402 Advanced Circuits and Fields II 3 (2-2) f s

Prerequisites: EE 302, MA 301

Required of seniors in Electrical Engineering.

A study of classical electric and magnetic field theory and its application

to the problems of electrical engineering. Consideration of electrostatics, magnetostatics, radiation, and guided waves. Staff

EE 430 Essentials of Electrical Engineering 4 (3-3) f

Prerequisite: EE 301 or EE 332

Not available to undergraduates in Electrical Engineering.

Essential theory of electric circuits, including electron tubes, solid state devices, transformers and rotating machines as needed to supply the electrical background for instrumentation and control theory. Intended primarily for graduate students who do not have an electrical engineering undergraduate degree. Staff

EE 431 Electronic Engineering 3 (2-3) f

Prerequisites: EE 302, EE 314

Departmental elective for seniors.

Comprehensive coverage of circuits and equipment using electronic devices; variable frequency effects; amplifiers, oscillators, modulators, detectors, wave-shaping circuits, generators of non-linear waveforms; basic pulse techniques; principles of electronic analogue computers. Emphasis on quantitative analysis and engineering design. Mr. Easter

EE 432 Communication Engineering 3 (2-3) s

Prerequisite: EE 431

Departmental elective for seniors in Electrical Engineering.

Application of electronic circuits and equipment to radio and wire communication systems. Elements of complete systems, wave propagation, antennas, transmitters, receivers, television, radar, electronic navigation systems, noise, special applications. Staff

EE 433 Electric Power Engineering 3 (2-3) f

Prerequisites: EE 302, EE 305

Departmental elective for seniors in Electrical Engineering.

A study of industrial power supply and power factor correction; direct and alternating current motor characteristics, starting methods, dynamic braking and speed control; motor applications, and industrial control apparatus. Mr. Herman

EE 434 Power System Analysis 3 (2-3) s

Prerequisites: EE 302, EE 305

Departmental elective for seniors in Electrical Engineering.

Analysis of problems encountered in the long-distance transmission of electric power. Line parameters of the method of geometric mean distances. Circles diagrams, symmetrical components, and fault calculations. Elementary concepts of power system stability. Applications of digital computers to power-system problems. Mr. Stevenson

EE 435 Elements of Control 3 (2-3) f

Prerequisites: EE 314, EE 305, or EE 430

Departmental elective for seniors in Electrical Engineering.

Introductory theory of open and closed loop control. Functions and performance requirements of typical control systems and system components. Dynamic analysis of error detectors, amplifiers, motors, demodulators, analogue components and switching devices. Component transfer characteristics and block diagram representation. Mr. Peterson

EE 438 Instrumentation in Nuclear Technology 3 (2-3) s

Prerequisites: Either EE 430 or EE 301, EE 314, MA 301

Required course in Nuclear Engineering, Instrumentation Option curriculum.

Radiation dectectors, pulse amplifiers, pulse shapers, amplitude discriminators, counters, coincidence circuits. Mr. Manning

EE 440 Fundamentals of Digital Systems *3 (3-0) s

Prerequisite: EE 314 or EE 430

Departmental elective for seniors in Electrical Engineering.

The basic theory of digital computation and control. Introduction to number systems, data handling, relay algebra, switching logic, memory circuits, the application of electronic devices to switching circuits, and the design of computer control circuits. Mr. Bell

EE 491 Electrical Engineering Senior Seminar 1 (0-2) f

Prerequisite: Senior standing

Required of seniors in Electrical Engineering.

Biweekly meetings for the delivery and discussion of student papers on topics of current interest in Electrical Engineering. Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

EE 503 Linear Network Theory 3 (3-0) f

Prerequisites: EE 302, EE 314, MA 301, B average in EE and MA

Analysis of linear networks, with emphasis on the system functions of the network in the frequency domain and response in the time domain. Mr. Stevenson

EE 504 Introduction to Network Synthesis 3 (3-0) s

Prerequisite: EE 503

A development of the methods of network synthesis of one-port and two-port passive structures based on partial fraction techniques. Mr. Stevenson

EE 506 Dynamical Analogies 3 (3-0) s

Prerequisites: EE 301 or EE 331, EM 312 or EM 301, MA 301, B average in EE, EM and MA

A study of dynamic systems in various branches of engineering and science with emphasis on the similarities that exist among such integrated groups of devices. Analogous elements and quantities in these fields as determined from equations basic to each. Analytical formulation of system problems in acoustical, electrical, mechanical, and related fields and their solution by analog methods. Use of electronic analog computers for the solution of system problems. Mr. Eckels

EE 507 Electromagnetics 3 (3-0) s

Prerequisites: EE 302, EE 314, MA 301, B average in EE and MA

Basic principles of electromagnetic field theory in vector analysis formulation, including static electric and magnetic fields, Maxwell's equations and applications to guided waves. Staff

EE 511 Electronic Circuits 3 credits f

Prerequisite: EE 314 or EE 430

Solid-state and vacuum electronic devices in amplifiers, feedback systems, oscillators, modulators, switching and wave-shaping circuits. Communication, power, and industrial applications. Synthesis of circuits to satisfy system requirements. Mr. Barclay

* Beginning in 1965-66 will be 3 (3-0) f.

EE 512 COMMUNICATION THEORY 3 (2-3) s

Prerequisites: EE 431, B average in EE and MA

The frequency and time domain, modulation, random signal theory, autocorrelation, basic information theory, noise, communications systems.

Mr. Barclay

EE 516 FEEDBACK CONTROL SYSTEMS 3 (3-0) s

Prerequisites: EE 401, EE 435

Departmental elective for seniors in EE.

Study of feedback systems for automatic control of physical quantities such as voltage, speed and mechanical position. Theory of regulating systems and servo-mechanisms steady state and transient response. Evaluation of stability. Transfer function loci and root locus plots. Analysis using differential equation and operational methods. System compensation and introduction to design. Mr. Peterson

EE 517 CONTROL LABORATORY 1 (0-3) s

Corequisite: EE 516

Laboratory study of feedback systems for automatic control of physical quantities such as voltage, speed and mechanical position. Characteristics of regulating systems and servo-mechanisms. The laboratory work is intended to contribute to an understanding of the theory developed in EE 516, Feedback Control Systems. Mr. Peterson

EE 520 FUNDAMENTALS OF LOGIC SYSTEMS 3 (3-0) f

Prerequisites: EE 314 or EE 430, B average in EE and MA

A study of switching algebra, logic circuitry, systematic minimization, block diagrams, logic systems in computers, diode and transistor logic, symmetric functions, iterative networks, cascaded systems, sequential circuits, and pulsed operation. Mr. Bell

EE 521 DIGITAL COMPUTER TECHNOLOGY AND DESIGN 3 credits s

Prerequisite: EE 520

A study of the internal organization and structure of digital devices, including toggle circuits, gates and pulse circuitry. Analysis and synthesis of the major components of computers, including the logic section, counters, registers, storage devices, input-output, and control. Mr. Bell

EE 531 INTRODUCTION TO SOLID STATE DEVICES 3 (3-0) f

Prerequisites: EE 314 or EE 430 or PY 403, MA 301

The object of this course is to introduce the student to the microscopic phenomena responsible for the operation of solid state electronic devices. A qualitative description of the band model of solids is followed by a description of the transport properties of charge carriers. P-n junction diodes and transistors, solar cells, controlled rectifiers, tunnel diodes, and unijunction transistors are treated along with more recently developed devices.

Mr. Lade

EE 533 TRANSISTOR CIRCUITS 3 (3-0) f

Prerequisites: EE 302, EE 314, B average in EE and MA

A study of the application of transistors to linear and switching circuitry. The electrical response of such systems is considered in the light of certain physical characteristics of the transistor, in addition to the piecewise linear model. Device characteristics, temperature stability, cascaded amplifiers, and elementary switching circuits are treated.

Mr. Manning

EE 591, 592 Special Topics in Electrical Engineering 3 (3-0) f s

Prerequisite: B average in technical subjects

A two-semester sequence to develop new courses, and to allow qualified students to explore unusual areas. Graduate Staff

COURSES FOR GRADUATES ONLY

EE 611, 612 Electric Network Synthesis 3 (3-0) f s

Prerequisite: EE 504

A study of modern network theory, with the emphasis on synthesis of both passive and active networks based on the work of Brune, Bode, Buillemin, Bott and Duffin, Darlington, Foster, Linville and many others. Both the realization problem and the approximation problem will be treated.
Mr. Hoadley

EE 613 Advanced Feedback Control 3 (3-0) s

Prerequisite: EE 516

An advanced study of feedback systems for the control of physical variables. Analysis of follower systems and regulators. Mathematical and graphical description of systems. Stability theory and performance criteria. Frequency response and root locus methods of analysis. System compensation and design. Introductory analysis of non-linear systems.
Mr. Peterson

EE 615 Electromagnetic Waves 4 (3-3) f

Prerequisite: EE 507

Maxwell's equations applied to a study of the propagation of energy by electromagnetic waves. Vector and scalar retarded potentials, propagation in free space, and material media, guided electromagnetic waves, common waveguides, skin effects, resonant cavities. Microwave network theory applied to measurement problems. Mr. Itoh

EE 616 Microwave Electronics 4 (3-3) s

Prerequisite: EE 615

Frequency limitations of conventional electron tubes. Microwave power generation and control by interaction of electromagnetic fields with charged particles and molecular energy levels, and by non-linear reactances. Applications in klystrons, magnetrons, traveling-wave tubes, masers, and reactance amplifiers. Measurement problems and techniques in microwave region. Mr. Barclay

EE 617 Pulse, Switching, and Timing Circuits 3 (3-0) f

Prerequisites: EE 503, EE 512

Tube and transistor circuit techniques for the production, shaping, and control of nonsinusoidal wave forms. Fundamental circuits needed in pulse information systems, instrumentation, and computers. Mr. Barclay

EE 618 Antennas and Propagation 4 (3-3) s

Prerequisite: EE 615

Electromagnetic wave theory applied to antennas and antennas arrays with emphasis on microwave frequencies. Calculation and measurement of directional characteristics, gain, field intensity, propagation via the ionisphere over various terrains, obstacle gain, gain height theory, forward scatter and other topics. Mr. Itoh

EE 623 Electronic Properties of Solid State Materials 3 (3-0) f

Prerequisite: EE 531 or PY 552

A study of the electronic properties of solids. Consideration of the motion of electrons in periodic potentials leads directly to the study of the band

theory and its consequences on the electrical and magnetic properties of materials. Beginning with the Boltzmann transport equations a phenomonelogical description of charge carrier flow is developed in terms of an effective mass tensor. Net electron transport, radiative transition mechanisms and high field effects will be treated in some depth. Mr. Lade

EE 624 Electronic Properities of Solid State Devices 3 (3-0) s

Prerequisite: EE 623

A study, in detail, of the terminal properties of a large class of solid state devices. Boundary relationships at solid-state interfaces will be considered in considerable depth along with the determination of added carrier profiles in neutral and non-neutral bulk regions. The role of deep lying traps on device performance will be treated as an introduction to a class of space-charge-limited devices. The present technology of device fabrication will be discussed and demonstrated. Mr. Lade

EE 641 Advanced Digital Computer Theory 3 (3-0) s

Prerequisite: EE 520

A study of the circuits and components of modern digital computers, including basic logic systems, codes, advanced systems of circuit logic, vacuum tube, transistor, and magnetic components. Memory devices, counters, converters, adders, accumulators, inputs, outputs, and computer control systems will be analyzed. Mr. Bell

EE 642 Automata and Adaptive Systems 3 (3-0) f

Prerequisite: EE 520

The study of neural nets in natural systems, artificial nerve nets, pattern-recognition devices, artificial intelligence, goal-directed behavior, self-repairing machines, the logic of automata, and adaptive Boolean logic. Mr. Bell

EE 643 Advanced Electrical Measurements 3 credits s

Prerequisites: EE 503, EE 431

A critical anlysis of circuits used in electrical measurements, with special attention to such topics as balance convergence, effects of strays, sensitivity, the use of feedback in electronic devices, automatic measuring systems, and digital measuring systems. Mr. Hoadley

EE 645, 646 Advanced Electromagnetic Theory 3 (3-0) f s

Prerequisites: EE 615 or PY 503, MA 512

A comprehensive study of electromagnetic theory with emphasis on field theory applications. Charges in both uniform and accelerated motion, field equivalence principles, anisopropic media, ferrite media, variational methods for waveguide discontinuities, periodic structures including Floquet's theorem, integral transform and function-theoretical techniques, solid state theory applied to quantum electronic devices. Mr. Itoh

EE 691, 692 Special Studies in Electrical Engineering 3 (3-0) f s

This course provides an opportunity for small groups of advanced graduate students to study, under the direction of qualified members of the professional staff, advanced topics in their special fields of interest. Graduate Staff

EE 695 Electrical Engineering Seminar 1 (1-0) f s

Prerequisite: Graduate standing in EE

A series of papers and conferences participated in by the instructional staff, invited guests, and students who are candidates for advanced degrees. Mr. Eckels

EE 699 Electrical Engineering Research credits by arrangements
Prerequisites: Graduate standing in EE and approval of advisor
Graduate Staff

ENGINEERING

E 100 Introduction to Engineering 0 (1-0) f

Introduces the student to the profession of engineering and the characteristics and requirements of the study of engineering.

E 101 Engineering Graphics I 2 (1-3) f s

A study is made of the graphical methods and techniques used in expressing, interpreting and communicating engineering ideas. Practical introductory engineering design problems to develop the students imagination and creative abilities will be considered.

E 102 Engineering Graphics II 1 (0-3) s

Prerequisite: E 101

Procedures used in representing and solving spatial problems graphically are covered. Emphasis is placed upon visualization of the relationship of objects in space through graphical analysis. Application of spatial techniques are made through the solutions of practical engineering problems.

E 207 Engineering Graphics III 2 (1-3) s

Prerequisite: E 102

Required of sophomores in Engineering Operations Curriculum.

The objective of this course is to provide the student with a more exact presentation of engineering data in the graphical medium. Production dimensioning, production characteristics of various types, free-hand sketching, production changes, and details and assembly drawings will be covered. Special emphasis will be placed upon the use of free-hand technical sketching in the communication of engineering data. (The above will include practices and standards peculiar to Mechanical, Electrical [Communication], Construction, Plant Design and related fields.)

E 500 Engineering Analysis 3 (3-0)

Prerequisites: Senior standing and selection for Honors Programs in Engineering

This is an engineering "case method" experience, making use of the principles of engineering, physics and mathematics. Professors in Engineering and certain key individuals from industry will work singly with the professor in charge to introduce challenging engineering situations and to stimulate student analysis.

ENGINEERING HONORS

EH 344 Dynamics 3 (3-0) f s

Prerequisite: For members of the Engineering Honors Program or by permission of the instructor

The study of the concepts and principles relating to the kinematics and kinetics of particles and rigid bodies. Illustration of the consequences and applications of the principles through problems of ballistics, orbital motion, vibrations, etc.

EH 345 Solid Mechanics 3 (3-0) f s

Prerequisites: EM 200, EH 344; for members of the Engineering Honors Program or by permission of the instructor

Introduction to the behavior of deformable solids. Development of relationships among loads, stresses, strains, and displacements. Mathematical representation and analysis of the behavior of shells, beams, shafts, columns, etc.

EH 346 Fluid Mechanics 3 (3-0) s

Prerequisites: EM 200 or EH 344; for members of the Engineering Honors Program or by permission of the instructor

Study of the concepts and principles relating to fluid mechanics. Equilibrium of liquids and gases, kinematics and dynamics of frictionless fluids. Motion of viscous fluids. Dynamics of gases. Flow measurement techniques.

EH 371 Thermodynamics I 3 (3-0) f

Prerequisite: For members of the Engineering Honors Program or by permission of instructor

A study of the basic principles and concepts of thermodynamics. Particular emphasis is placed on first and second laws, their implications and applications. The properties of actual and real gases are investigated and also the interrelationships between the properties as given by the general equations of thermodynamics.

EH 372 Thermodynamics II 3 (3-0) s

Prerequisite: EH 371, for members of the Engineering Honors Program or by permission of instructor

The statistical approach to thermodynamics and the application to determination of specific heats. Entropy and probability. The thermodynamics of fluid flow including supersonic flow. The basic laws of heat transfer. Ideal gas and vapor cycles. Introduction to chemical thermodynamics.

EH 395 Contemporary Trends in Engineering and Science 1 (1-0) f s

Prerequisite: For members of the Engineering Honors Program or by permission of instructor

Representatives from various fields of engineering or science discuss topics of current significance in their areas of interests.

EH 401 Special Topics in Engineering 1 to 4 credits f s

Prerequisite: For members of the Engineering Honors Program or by permission of instructor

Special projects in various phases of engineering, either of a research or design nature.

EH 495 Engineering Honors Seminar 1 (1-0)

Prerequisite: For seniors in the Engineering Honors Program or by permission of instructor

Individual presentation by the students of their projects conducted in connection with the Honors Program.

ENGINEERING MECHANICS

COURSES FOR UNDERGRADUATES

EM 200 Introduction to Mechanics 3 (3-0) f s

Corequisite: MA 301

An introduction to the principles and concepts which form the basis for

studies in dynamics, solid mechanics, and fluid mechanics. The nature and properties of force systems and stress fields. The motion of particles and description of deformation of continuous media. The role of Newton's laws, the concepts of continuity and equilibrium, and the conservational principles in problems in mechanics.

EM 211 Introduction to Applied Mechanics 3 (3-0) f s
Corequisites: MA 212, PY 212

This course is intended to acquaint the student with the concepts of particle and rigid body mechanics. The fundamentals of equilibrium, kinematics and kinetics are applied to engineering problems involving structures and machines.

EM 212 Mechanics of Engineering Materials 3 (2-1) f s
Prerequisite: EM 211

This course constitutes a study of the properties of engineering materials with special emphasis on the mechanical parameters. It is especially conceived to prepare the student for the selection and specification of materials common to engineering practice. A particular emphasis is given to mechanical aspects of materials employed in design.

EM 301 Mechanics I 3 (3-0) f s
Prerequisite: EM 200

Introduction to the mechanics of deformable solids. Development of the equations which describe the linear elastic solid. Approximate solutions and solutions governed by the theory of elasticity to problems involving prescribed force systems, states of motion, or energy inputs.

EM 302 Mechanics II 3 (3-0) f s
Prerequisites: EM 301

Continuation of EM 301. Equations for thin plates. Introduction to the theory of plasticity. Theories of yielding, plastic stress-strain relationships, and two-dimensional problems in plastic behavior.

EM 303 Fluid Mechanics I 3 (3-0) f s
Prerequisite: EM 200

Development of the basic equations of fluid mechanics in general and specialized form. Application of these specialized equations to a variety of topics including (1) fluid statics, (2) inviscid, incompressible fluid flow, and (3) viscous, incompressible fluid flow.

EM 304 Fluid Mechanics II 3 (3-0) f s
Prerequisite: EM 303

Continuation of EM 303. Further applications of the basic equations of fluid mechanics to (1) boundary layer analysis, (2) laminar and turbulent flows and (3) compressible fluid flow. Introduction to experimental methods in fluid mechanics.

EM 401 Experimental Mechanics I 3 (0-6) f s
Prerequisites: EM 301, EM 303

A course in the principal experimental methods employed in the analysis of contemporary problems of engineering in which mechanics dominates. Special emphasis is given to those phenomena which give rise to instruments for measurement of prime mechanical variables. Experimental analysis of mechanical fields and interpretation of data are major topics.

EM 402 Experimental Mechanics II 3 (0-6) f s
Prerequisite: EM 401

Selected experiments which illustrate basic phenomena of mechanics

in engineering systems. A particular emphasis is the experimental synthesis of such systems and the evaluation of their behavior as designed.

EM 430 Fluid Mechanics 2 (2-0) f s

Prerequisite: EM 342

Fluid statics, kinematics, Bernoulli equation, momentum, free-surface flow, viscosity, pipe friction, drag on submerged bodies, lift, elastic wave propagation.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

EM 501, 502 Continuum Mechanics I, II 3 (3-0) f s

Prerequisites: EM 301, EM 303, ME 301, MA 405

The concepts of stress and strain are presented in generalized tensor form. Emphasis is placed on the discussion and relative comparison of the analytical models for a series of continua including the linear elastic solid, the perfect fluids and the viscous (Newtonian) fluid. The underlying thermodynamic principles are presented, the associated boundary value problems are formulated and selected examples are used to illustrate the theory.

EM 503 Theory of Linear Elasticity 3 (3-0) f s

Prerequisites: EM 301, MA 301

The differential equation approach employed in development of the equations representing the behavior of a linear elastic solid. The elastic problem formulated in two and three dimensions and various coordinate systems. Application of the theory illustrated through selected problems.

EM 504 Mechanics of Ideal Fluids 3 (3-0) f s

Prerequisite: EM 430 or EM 304

Corequisite: MA 513

Basic equations of ideal fluid flow; potential and stream functions; vortex dynamics; body forces due to flow fields; method of singularities in two-dimensional flows; analytical determination of potential functions; conformal transformations; free-streamline flows.

EM 505 Mechanics of Viscous Fluids I 3 (3-0) f

Prerequisite: EM 430 or EM 304

Corequisite: MA 532

Equations of motion of a viscous fluid (Navier-Stokes Equations); general properties of the Navier-Stokes equations; some exact solutions of the Navier-Stokes equations; boundary layer equations; some approximate methods of solution of the boundary layer equations; laminar boundary layers in axi-symmetric and three-dimensional flows; unsteady laminar boundary layers.

EM 506 Mechanics of Compressible Fluid I 3 (3-0) f

Prerequisites: EM 430 or EM 304, ME 302

Corequisite: MA 532

Introduction to compressible fluid flow; isentropic, one-dimensional flow; Rayleigh and Fanno line flows; generalized one-dimensional flow; normal shock waves; introduction of multi-dimensional, compressible flow.

EM 509 Space Mechanics I 3 (3-0) f

Prerequisites: EM 302, EM 304

Corequisite: MA 511

The application of mechanics to the analysis and design of orbits and trajectories. Trajectory computation and optimization; space maneuvers; re-entry trajectories; interplanetary guidance.

EM 510 Space Mechanics II 3 (3-0) s

Prerequisites: EM 509, MA 511

Continuation of EM 509. The analysis and design of guidance systems. Basic sensing devices; the characteristics of an inertial space; the theory of stabilized platform; terrestrial inertial guidance.

EM 511 Theory of Plates and Shells 3 (3-0) s

Prerequisites: EM 301 accompanied by MA 511

A modern study of the theory of plates and shells. Topics are selected from problems involving membranes; folded plates, circular and rectangular slabs, domes, cylindrical shells and hyperbolic paraboloids. Solutions are obtained by both classical and modern numerical methods.

EM 551 Advanced Strength of Materials 3 (3-0) f

Prerequisites: EM 301

Stresses and strains at a point; rosette analysis; stress theories, stress concentration and fatigue; plasticity; inelastic, composite and curved beams; prestress energy methods shear deflections; buckling problems and column design; and membrane stresses in shells.

EM 552 Elastic Stability 3 (3-0) f

Prerequisites: MA 301, MA 405, EM 551

A study of elastic and plastic stability. The stability criterion as a determinant. The energy method and the theorem of stationary potential energy. The solution of buckling problems by finite differences and the calculus of variations. The application of successive approximations to stability problems. Optimization applied to problems of aeroelastic and civil engineering structures.

EM 555 Dynamics I 3 (3-0) f

Prerequisites: EM 301, MA 405

The theory of vibrations from the Lagrangian formulation of the equations of motion. Free and forced vibrations with and without damping, multiple degrees of freedom, coupled motion, normal mode vibrations, wave propagation in solid bodies.

EM 556 Dynamics II 3 (3-0) s

Prerequisites: EM 301, MA 405

The dynamics of particles and rigid bodies by the use of formulations of the laws of mechanics due to Newton, Euler, Lagrange, and Hamilton. Accelerated reference frames, constrains, Euler's angles, the spinning top, the gyroscope, precession, stability, phase space, and nonlinear oscillatory motion.

COURSES FOR GRADUATES ONLY

EM 601, 602 Unifying Concepts in Mechanics I, II 3 (3-0) f s

Prerequisite: PY 601

Generalized treatment of the fundamental equations and boundary value problems of continuous and non-continuous media. Use is made of contemporary developments in irreversible thermodynamics, statistical mechanics, and electrodynamics to provide a unified foundation for the development of principles governing the dynamic and thermodynamic behavior of elastic, plastic and visco-elastic solids, viscous fluids and rheological media.

EM 604 Theory of Plasticity 3 (3-0) s

Prerequisite: EM 503

Development of the equations representing the plastic behavior of deformable solids. Yield conditions and plastic stress-strain relations. Plane strain

theory, hyperbolic equations and slip linefields. Selected problems to illustrate the theory.

EM 611 Mechanics of Compressible Fluids II 3 (3-0) s

Prerequisite: EM 506

Continuation of EM 506; linearized theory of two-dimensional, compressible flow; method of characteristics for two-dimensional supersonic flow; oblique shock waves; unsteady one-dimensional flow; shock-wave boundary layer interactions; transonic flow.

EM 612 Mechanics of Viscous Fluids II 3 (3-0) s

Prerequisite: EM 505

Continuation of EM 505; phenomenological theories of turbulence; turbulent flow in ducts and pipes; turbulent boundary layer with and without pressure gradient; compressible boundary layer with and without pressure gradient; compressible boundary layer; boundary layer control; free viscous flow.

EM 695 Experimental Methods in Mechanics maximum 6 s

Prerequisite: Consent of instructor

The study of specialized experimental techniques utilized in contemporary research in the areas of Mechanics.

EM 697 Seminars in Mechanics maximum 3 f

Prerequisites: Graduate standing and consent of advisor

The discussion and development of theory relating to contemporary research in the frontier areas of Mechanics.

EM 698 Special Topics in Mechanics maximum 9 f s

The study, by small groups of graduate students under the direction of members of the faculty, of topics of particular interest in various advanced phases of Mechanics.

EM 699 Research in Mechanics maximum 6 f s

Individual research in the field of Mechanics.

ENGLISH

FRESHMAN ENGLISH

ENG 111 Composition and Rhetoric 3 (3-0) f s

Required of all freshmen.

Intensive study and practice in the basic forms and principles of expository communication; conferences.

ENG 112 Composition and Reading 3 (3-0) f s

Required of all freshmen.

Continued practice in expository writing; research paper; introduction to literary types; collateral reading; conferences.

Note: Qualified students will be allowed to register for ENG 112A and will be given credit for 111 upon successful completion of the course. Eligibility for 112A will be based on a predetermined score on the Verbal Aptitude and Achievement sections of the SAT plus a composition to be written at the first or second class meeting of the 112A section.

Note: The prerequisite for all advanced courses in writing, language, speech, or literature is the completion of 111 and 112 with a grade of C or better in at least one semester. The minimum recommended prerequisite

for literature courses of the 300 level or above is ENG 205 or any semester of ENG 261-262 or ENG 265-266.

WRITING

ENG 211 Business Communications 3 (3-0) f s

Practical application of the principles of composition to effective business communications, including basic types of correspondence and written and oral reports; vocabulary building, and basic semantics.

ENG 215 Principles of News and Article Writing 3 (3-0) f s

Introduction to the writing of simple news articles; class criticism of nontechnical newspaper and magazine articles.

ENG 216 Advanced Article Writing 3 (3-0) s

Prerequisite: ENG 215 or equivalent

A continuation of ENG 215, with intensive practice in writing and criticizing nontechnical articles.

ENG 222 Advanced Composition (Creative Writing) 3 (3-0) s

A course in creative writing especially designed for students who have demonstrated ability; emphasis on short prose fiction.

ENG 223 Vocabulary Building 3 (3-0) s

A system of increasing the student's mastery of useful words as found in the best modern English prose.

ENG 321 Scientific Writing 3 (3-0) f s

Prerequisite: Junior or Senior standing

Intensive practice in writing technical and scientific reports, articles for journals, and business letters relating to technical reports.

LANGUAGE

ENG 324 Modern English Usage 3 (3-0) f

An intensive study of English grammar with particular emphasis on contemporary usage.

ENG 326 History of the English Language 3 (3-0) s

A survey of the growth and development of the language.

SPEECH

ENG 230 Fundamentals of Speech 3 (3-0) f s

Directed experience in the various skills of oral communication: public speaking, group discussion, and interpretative reading. Includes selection and evaluation of materials, organization, thought, voice, action, and speaker-listener relations.

ENG 231 Basic Public Speaking 3 (3-0) f s

Preparation and delivery of various kinds of speeches: informative, entertaining, persuasive. Practice in both formal and informal speaking. Stress on rhetorical principles involved in public speaking.

ENG 237 Group Discussion 3 (3-0) f s

Prerequisite: ENG 230, ENG 231 or approval of instructor

The theory and practice of leading and taking part in such groups as panels, forums, symposiums, conferences, and committees. Oral and written assignments. Frequent recordings.

ENG 310 Voice and Diction 3 (3-0) f s

Intensive study of the mechanics of effective voice production, chief patterns of American speech, and general linguistic principles. Selected exercises and practice in developing an effective speech pattern.

ENG 332 Argumentation and Persuasion 3 (3-0) f

Prerequisite: ENG 230, ENG 231 or equivalent

Analysis, brief-drawing and evidence, and methods of proof and refutation; fundamentals of conviction; naturalness and forcefulness, extempore speeches, debates and discussions.

ENG 333 Public Address and Extemporaneous Speaking 3 (3-0) s

Prerequisite: ENG 230, ENG 231 or equivalent

Public speaking for special occasions, including speech of introduction, committee-room speech, after-dinner speech, speech at a professional convention, political speech, formal sales talk.

ENG 334 Oral Reading 3 (3-0) f s

Prerequisite: ENG 230, ENG 231 or approval of instructor

Training in the analysis and presentation of printed materials—literary, technical, and semitechnical—for platform, radio, and television.

ENG 336 Parliamentary Practice 3 (3-0) f s

Rules and customs of assemblies, including organization, motions; participation in and conduct of meetings; parliamentary strategy.

ENG 340 Play Production 3 (3-0) f s

A survey of methods and techniques in staging dramatic art. Organizing, play selection, casting, directing, acting, scene design and construction, lighting.

LITERATURE

ENG 205 Reading for Discovery 3 (3-0) f s

A study of selected masterworks drawn from American, English, and European literature with emphasis on the great themes and on the approach of the creative artist to basic ideas in Western culture.

ENG 261 English Literature I 3 (3-0) f

A survey course in English literature from the Anglo-Saxon invasions to the Romantic period.

ENG 262 English Literature II 3 (3-0) s

A survey of English literature from the Romantic period to the present day. This course may be taken either as a continuation of ENG 261 or as an independent course.

ENG 265 American Literature I 3 (3-0) f

A survey of American literature from the colonial settlements through the New England revival of the nineteenth century.

ENG 266 American Literature II 3 (3-0) s

A survey of American literature from Mark Twain to Faulkner. This course may be taken either as a continuation of ENG 265 or as an independent course.

ENG 351 The Eighteenth Century 3 (3-0) f

A study of the poetry and prose of Addison, Steel, Swift, Pope, Johnson, Boswell, Gray, and Cowper.

ENG 353 THE ROMANTIC PERIOD 3 (3-0) s

A study of the poetry of Wordsworth, Coleridge, Byron, Shelley, and Keats, with readings in the prose of Lamb, De Quincey, and others.

ENG 360 LITERATURE OF SCIENTIFIC THOUGHT 3 (3-0) f s

Chief documents of scientific thought from Aristotle to the present day with emphasis on literary values. (Not offered in 1964-66.)

ENG 363 THE VICTORIAN PERIOD 3 (3-0) s

Major poets and selected prose writers studied against the social, economic, scientific, and theological background of the century.

ENG 371 THE NOVEL 3 (3-0) f s

Intensive analysis of some of the most influential English, American, and Continental novels chosen to illustrate the structure and the development of the form.

ENG 375 SOUTHERN WRITERS 3 (3-0) s

An introduction to Southern culture as revealed in poetry, fiction, and essays from Poe to the present day. (Offered in alternate years.)

ENG 380 MODERN DRAMA 3 (3-0) s

Plays by representative modern American, British, and European playwrights, beginning with Ibsen and continuing up to such current forms as the drama of the "absurd."

ENG 382 SHORT PROSE FICTION 3 (3-0) f

The study of selected short stories by the most representative of contemporary British and American writers. (Offered in alternate years.)

ENG 396 LITERATURE OF THE WESTERN WORLD 3 (3-0) f

Readings from selected great books from the Homeric period of Greek literature to the Renaissance in Europe. Emphasis on the contributions of this literature to modern thought.

ENG 397 LITERATURE OF THE NON-WESTERN WORLD 3 (3-0) s

Study of a selected group of translations from the literature of Persia, India, China, and Japan as they reflect cultural backgrounds. (Offered in alternate years.)

ENG 398 CONTEMPORARY LITERATURE 3 (3-0) f s

A study of the selected examples of American, British, and Continental writing from 1890 to the present day with reference to changing literary forms and themes.

ENG 451 CHAUCER 3 (3-0) f

A careful reading of *The Canterbury Tales* and *Troilus and Criseyde*, together with selections from minor poems.

ENG 461 MILTON 3 (3-0) f

The works of Milton studied against the background of his life and the religious, political, and cultural traditions of his times. (Not offered in 1964-65.)

ENG 468 MAJOR AMERICAN WRITERS 3 (3-0) f s

Concentrated study of the writings of Emerson, Thoreau, Melville, and Whitman as they exemplify the spirit of American individualism.

ENG 485 SHAKESPEARE 3 (3-0) f s

A study of the principal plays with emphasis on the development of the playwright.

ENG 496 Literary Analysis (Senior Seminar) 3 (3-0) f s

Prerequisite: Departmental approval

A flexible course in reading and criticism designed to synthesize the student's preceding work in literature and to provide a capstone for his undergraduate program.

ENTOMOLOGY

COURSES FOR UNDERGRADUATES

ENT 301 Introduction to Forest Insects 3 (2-2) f

An introductory course covering the fundamentals of classification, development, habit, and control of forest insects. Mr. Farrier

ENT 312 Introduction to Economic Insects 3 (2-2) f s

A basic course, covering the fundamentals of insect classification, development, food habits, and controls. Mr. Brett

ENT 322 Beekeeping 3 (2-2) s

Prerequisite: Consent of instructor

A basic course dealing with the place of the honeybee in our agricultural economy; the colony and its components; management; manipulation; honey production, care and marketing.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ENT 401 Literature of Biology 1 (1-0) f

General course intended to acquaint student with literature problems of the scientist, mechanics of the library book classifications, bibliographies, abstract journals, taxonomic indexes, and preparation of scientific papers in agriculture, forestry, biology, and their sub-divisions. Mr. Farrier

ENT 502 Fundamentals of Entomology 5 (2-6) f

Prerequisites: Twelve hours of Biology, ENT 301 or ENT 312 or equivalent

An intensive treatment of the general external morphology of insects and a survey of the adults and immatures of the orders and principal families of insects with attention to their biology.

Messrs. Neunzig, Rabb, Young

ENT 503 Fundamentals of Entomology 5 credits s

Prerequisites: Twelve hours of Biology, nine hours of Chemistry, ENT 301 or equivalent

Structure and morphological variations of organ systems in insects including considerations of their histology and function. Sensory physiology and behavior will then lead into the basic elements of insect ecology.

Messrs. Campbell, Hodgson, Rabb, Young

ENT 504 Insect Morphology 3 (1-4) f

Prerequisite: ENT 502

Concerned with external morphology, primary and comparative phases, with emphasis on knowledge and techniques which can be applied to specific problems. (Will be offered 1965-66 and fall of alternate years.)

Mr. Young

ENT 511 Systematic Entomology 3 (1-4) f

Prerequisite: ENT 301 or ENT 312 or equivalent

A somewhat detailed survey of the orders and families of insects, designed to acquaint the student with those groups and develop in the student some ability in the use of keys, descriptions, etc. (Offered 1964-65 and fall of alternate years.) Mr. Young

ENT 531 Insect Ecology 3 (2-2) f

Prerequisites: ENT 301 or ENT 312 or equivalent

The environmental relations of insects, including insect development, habits, distribution and abundance. (Will be offered 1965-66 and fall of alternate years.) Mr. Rabb

ENT 541 Immature Insects 2 (1-3) f

Prerequisite: ENT 502 or permission of instructor

An advanced study of the immature stages of selected orders of insects, with emphasis on generic and specific taxa. Primary consideration is given to the larval stage, but a brief treatment of eggs and pupae is also included. (Offered 1964-65 and fall of alternate years.)

Messrs. Neunzig, Rabb

ENT 551 Fundamentals of Insect Control 3 credits f

Prerequisites: ENT 312 or equivalent, twelve hours of Chemistry, twelve hours of Biology

The course is divided into two phases. The first deals with the basic causes of insect problems, an evaluation of the biological and economic aspects of insect attack, and the fundamental methods employed in insect control. The second part deals with the critical chemical, physical, and biological properties of compounds used for insect control. The material presented in the course is directed toward obtaining fundamental knowledge of the scientific principles underlying modern methods of protection of food, clothing, shelter, and health from arthropods. Mr. Guthrie

ENT 552 Applied Entomology 3 credits s

Prerequisites: ENT 502, ENT 503, ENT 551

A course dealing with the organization of the field of applied entomology, the significance of other disciplines, research and extension methods, the concept of integrated control, and the solution of economic problems. (Will be offered 1965-66 and spring of alternate years.) Mr. Mistric

ENT 572 Forest Entomology 3 credits s

Prerequisite: ENT 301 or ENT 312

A study of the methods of identification of forest pests, the factors governing their abundance, habits and control. (Will be offered 1965-66 and spring of alternate years.) Mr. Farrier

ENT 582 (ZO 582) Medical and Veterinary Entomology (Parasitology) 3 (2-3) s

Prerequisite: ENT 301 or ENT 312, ZO 581

A study of the morphology, biology and control of the parasitic arthropods of man, domestic and wild animals. (Will be offered 1965-66 and spring of alternate years.) Mr. Axtell

ENT 590 Special Problems credits by arrangements f s

Prerequisites: Graduate standing and consent of instructor

Original research on special problems in entomology not related to a thesis problem, but designed to provide experience and training in research.

ENT 592 Acarology 3 (2-2) s

Prerequisite: ENT 301 or ENT 312 or ZO 103

A systematic survey of the mites and ticks with emphasis on identification, biology and control of the more common and economic forms attacking materials, plants and animals including man. (Offered 1964-65 and spring of alternate years.) Mr. Farrier

ENT 602 Principles of Taxonomy 3 (1-4) s

Prerequisite: ENT 511

A course introducing the methods and tools used in animal taxonomy, designed to promote a better understanding of taxonomic literature, and provide a foundation for taxonomic research. (Offered 1964-65 and spring of alternate years.) Mr. Young

ENT 611 Biochemistry of Insects 3 (3-0) f

Prerequisite: CH 551 or permission of instructor

The biochemistry of insects will be considered with primary emphasis on intermediate metabolism. Aspects in which insects show specialization will be treated in greater detail. The comparative treatment used necessitates some consideration of other animal groups.
(Offered 1964-65 and fall of alternate years.) Mr. Hodgson

ENT 622 Insect Toxicology 3 (2-3) s

Prerequisites: ENT 551, CH 551 or equivalent

The relation of chemical structure to insect toxicity, the mode of action of toxicants used to kill insects, the metabolism of insecticides in plant and animal systems, the selectivity within the cholinesterase inhibitors and other selective mechanisms, and the analysis of insecticide residues will be discussed. (Will be offered 1965-66 and spring of alternate years.)
Messrs. Dauterman, Guthrie

ENT 690 Seminar 1-1 f s

Prerequisite: Graduate standing in Entomology or closely allied fields

Discussion of entomological topics selected and assigned by Seminar Chairman. Graduate Staff

ENT 699 Research credits by arrangement

Prerequisite: Graduate standing in Entomology or closely allied fields

Original research in connection with thesis problem in entomology.
Graduate Staff

EXPERIMENTAL STATISTICS

COURSES FOR UNDERGRADUATES

ST 302 Machine Techniques For Data Processing 2 (1-2) s

The use of the unit record machines with special emphasis on the processing of data using a stored program calculator.
Mr. Verlinden

ST 311 Introduction to Statistics 3 (2-2) f s

This course will relate general statistical concepts to everyday life and will emphasize giving perspective to these concepts in place of developing skill. Quantitative descriptions of populations, sampling ideas, techniques of making inference about populations from samples and the uncertainties involved in such inferences. Formulation and testing of hypotheses, elementary and basic statistical techniques. Mr. McVay

ST 312 Introduction to Statistics II 3 (2-2) s
Prerequisite: ST 311

This course is a continuation of ST 311 for those students who desire further work in elementary statistical methods. Included are analysis of variance with multiple classification, covariance, an introduction to multiple regression, elements of experimental design, additional application of chi-square tests, and elements of sample survey and census techniques.
Mr. Monroe

ST 361 Introduction to Statistics for Engineers I 3 (3-0) f s
Prerequisite: College Algebra

Survey of statistical techniques useful to engineers and physical scientists. Includes elementary probability, frequency distributions, sampling variation, estimation of means and standard deviations, confidence intervals, significance tests, control charts, elementary least squares curve fitting.
Messrs. Grandage, Hader

ST 362 Introduction to Statistics for Engineers II 3 (2-2) s
Prerequisite: ST 361

Continuation of ST 361. Additional and more advanced statistical methodology for engineers and physical scientists. Includes least squares method for fitting polynominals and multiple regression; chi-square tests; sampling acceptance inspection; introduction to analysis of variance and design of experiments.
Messrs. Grandage, Hader

ST 371 Introduction to Probability and Statistics 4 (3-2) f
Prerequisite: MA 201

Basic concepts of probability and statistics for students in the physical sciences and engineering; simple probability models, random variables, distributions, functions of random variables, sampling, data description, testing hypotheses, estimation; simple applications of concepts; test of means, variances, goodness of fit, randomness, etc., control charts, analysis of variance, regression.
Mr. Grandage

ST 421, 422 Introduction to Mathematical Statistics 3 (3-0) f s
Prerequisite: MA 202 or MA 212

Elementary mathematical statistics primarily for students not intending to take further work in theoretical statistics. Includes introduction to probability, common theoretical distributions, moments, moment generating functions, sampling distributions, (F, t, chi-square), elementary estimation, hypothesis testing concepts, decision theory concepts, and elements of general linear model theory.
Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ST 501, 502 Basic Statistical Analysis 3 (3-0) f s
Prerequisite: ST 311 or equivalent or graduate standing

Basic concepts of statistics; random variables, distributions, statistical measures, estimation, tests of significance, analysis of variance, elementary design and sampling, factorial experiments, multiple regression, analysis of discrete data, and other topics. Intended primarily for statistics graduate majors and Ph.D. minors and not intended as a service course for other departments.
Mr. Steel

ST 511 Experimental Statistics for Biological Sciences I 3 (3-0) f s
Prerequisite: ST 311 or graduate standing

Basic concepts of statistical models and use of samples; variation, statistical measures, distributions, tests of significance, analysis of variance and elementary experimental design, regression and correlation, chi-square.
Messrs. Monroe, Rawlings

ST 512 Experimental Statistics for Biological Sciences II 3 (3-0) f s
Prerequisite: ST 511 or equivalent

Covariance, multiple regression, concepts of experimental design, factorial experiments, individual degrees of freedom, confounded factorial and split plot designs, and incomplete block designs. Messrs. Mason, Monroe

ST 513 Experimental Statistics for Social Sciences I 3 (3-0) f
Prerequisite: ST 311 or graduate standing

Basic concepts in collection and analysis of data. Variability of sample data, distributions, confidence limits, chi-square, t-test, analysis of variance, regression, correlation, analytic and descriptive surveys, experimental designs. Mr. McVay

ST 514 Experimental Statistics for Social Sciences II 3 (3-0) s
Prerequisite: ST 513 or equivalent

Extension of basic statistical concepts to social experiments and surveys; sampling from finite populations and estimating using unrestricted, stratified, systematic, and multistage selections; analysis of variance continued; multiple regression; covariance; experimental designs. Mr. Proctor

ST 515, 516 Experimental Statistics for Engineers 3 (3-0) f s
Prerequisite: ST 361 or graduate standing

General statistical concepts and techniques useful to research workers in engineering, textiles, wood technology, etc. Probability, distributions, measurement of precision, simple and multiple regression, tests of significance, analysis of variance, enumeration data, sensitivity data, life testing experiments and experimental design. Mr. Hader

ST 541 Theory of Probability I 3 (3-0) f
(See MA 541)

ST 542 Theory of Probability II 3 (3-0) s
(See MA 542)

ST 551 Basic Statistical Inference 3 (2-2) s
Prerequisites: MA 511, ST 541 (MA 541)

Frequency distributions and moments; sampling distributions; introductory theory of point and interval estimation; tests of hypotheses. Mr. Grandage

ST 552 Basic Theory of Least Squares and Variance Components 3 (2-2) f
Prerequisites: ST 551, MA 405

Theory of least squares; multiple regression; analysis of variance and covariance; experimental design models; factorial experiments; variance component models. Mr. Anderson

ST 571 (BS 571, MA 571) Biomathematics I 3 (3-0) f
Prerequisites: MA 301, MA 405 or consent of instructor

Linear time-invariant operators and their Laplace transforms, with a discussion of homogeneous and non-homogeneous linear differential equations and their analysis in time domain and frequency domain; applications to the study of input and output in biological systems; systems of linear and non-linear differential equations and their perturbation equations, especially with reference to the study of population dynamics and growth processes, stability of biological systems, and tracer kinetics. Mr. van der Vaart

ST 572 (BS 572, MA 572) BIOMATHEMATICS II 3 (3-0) s
Prerequisites: ST 571, ST 541 (MA 541) or consent of instructor

Continuation of topics in ST 571. The general framework for mathematization of biological problems; deterministic and stochastic models; birth and death processes with applications to physiology and population dynamics; desirable features of mathematical models in biology. Mr. van der Vaart

ST 591 SPECIAL PROBLEMS 1-3 credits by arrangements f s

Development of techniques for specialized cases, particularly in connection with thesis and practical consulting problems. Graduate Staff

COURSES FOR GRADUATES ONLY

ST 606 (MA 606) MATHEMATICAL PROGRAMMING II 3 (3-0) s
Prerequisite: IE 505 or MA 505

This course is intended for those who desire to study linear and non-linear programming from an advanced mathematical point of view. Special attention will be paid to the theoretical and computational aspects of current research problems in the field of mathematical programming, including linear programming and game theory, theory of graphs, discrete linear programming, linear programming under uncertainty and non-linear programming. Mr. Bhattacharyya

ST 611, 612 INTERMEDIATE STATISTICAL THEORY 3 (3-0) f s
Prerequisites: ST 551, MA 512, MA 405

This course will provide the additional theory, above that of ST 551, needed for many advanced theory courses. Many of the topics of ST 551 will be developed more rigorously, with more attention paid to mathematical aspects. Advanced probability theory; limit theorems, distribution theory, multinormal distributions. Statistical decision theory, theory of estimation, confidence regions, theory of tests of hypotheses, sequential tests, non-parametric methods. Mr. Bhattacharyya

ST 613 TIME SERIES ANALYSIS I 3 (3-0) s
Prerequisite: ST 552

Statistical analysis of realizations of second order stationary random processes, and mathematical specifications of the underlying processes, with emphasis throughout on the spectrum. Discussions of applications are given to illustrate the theory and methods. Topics include second order stationary parent sequences, correlation analysis, autoregressive series, moving averages, hidden periodicities models, spectral analysis, estimation of the correlogram and the coefficients of autoregressive schemes, the periodogram, estimation of the spectral density; serial correlation theory, goodness-of-fit tests. Mr. Herbst

ST 614 TIME SERIES ANALYSIS II 3 (3-0) f
Prerequisites: ST 613, ST 542 (MA 542)

Cross-covariance analysis of two time series, cross-spectral analysis of two time series, estimation of co-spectral density, quadrature-spectral density, coherence and phase, interpretations and applications of coherence analysis, detection and estimation of periodicities in variances of time series, spectral representation theory for second order stationary processes, further discussion of spectral estimation. Mr. Herbst

ST 621 STATISTICS IN ANIMAL SCIENCE 3 (3-0) f
Prerequisite: ST 502 or equivalent

Sources and magnitudes of errors in experiments with animals, experimental designs and methods of analysis adapted to specific types of animal

research, relative efficiency of alternate designs, amount of data required for specified accuracy, student reports on selected topics.
(Offered in fall of 1965-66 and alternate years.) Mr. Lucas

ST 622 Principles of Biological Assays 3 (2-2) s
(See ANS 622)

ST 623 Statistics in Plant Science 3 (3-0) f
Prerequisite: ST 502 or equivalent

Principles and techniques of planning, establishing, and executing field and greenhouse experiments. Size, shape and orientation of plots; border effects; selection of experimental material; estimation of size of experiments for specified accuracy; scoring and subjective tests; subsampling plots and yields for laboratory analysis. Mr. Mason

ST 626 Statistical Concepts in Genetics 3 (3-0) s
Prerequisite: GN 512
Corequisite: ST 502 or equivalent

Factors bearing on rates of change in population means and variances, with special reference to cultivated plants and domestic animals; selection, inbreeding, magnitude and nature of genotypic and non-genotypic variability; experimental and statistical approaches in the analysis of quantitative inheritance. Mr. Cockerham

ST 631 Theory of Sampling Applied to Survey Design 3 (3-0) f
Prerequisite: ST 422 or ST 502 or equivalent

Principles for interpretation and design of sample surveys. Biases, variances and costs of estimators. Comparisons among simple random sample, ratio estimation, stratification, varying probabilities of selection, multistage, systematic and cluster sampling, double sampling. Response errors.
Mr. Proctor

ST 641 Statistics in Sociology 3 (3-0) s
(See RS 641)

ST 651 Econometric Methods I 3 (3-0) f
(See AGC 651)

ST 652 (AGC 652) Econometric Methods II 3 (3-0) s
Prerequisites: ST 422 or ST 552, MA 405

Techniques for problems analysis in agricultural economics; attention to analysis of time series data; non-parametric inference; experimental design in economic research; estimation of parameters in production functions and in simultaneous models; selected special topics.
Messrs. Anderson, Bhattacharyya

ST 671 Advanced Topics in Least Squares and Variance Components 3 (3-0) s
Prerequisites: ST 502 or equivalent, ST 552

Use of non-balanced designs to estimate variance components; comparison of estimators; problems with finite populations. Least squares procedures for non-standard conditions; unequal variances, correlated errors, non-additivity, measurement errors, non-normality. Functional relationships. Factorial experiments with continuous factor levels; incomplete blocks.
Mr. Anderson

ST 672 Special Advanced Topics in Statistical Analysis 3 (3-0) f
Prerequisites: ST 502 or equivalent, ST 522

Enumeration data; covariance; non-linear models; discriminant functions and other multivariate techniques. Mr. Monroe

ST 674 Advanced Topics in Construction and Analysis of Experimental Designs 3 (3-0) s

Prerequisites: ST 502 or equivalent, ST 552

Inter-block analysis of incomplete blocks designs, partially balanced designs, confounding, data collected at several places and times, multiple factor designs, change-over trials, analysis of groups of means. Graduate Staff

ST 691 Advanced Special Problems 1-3 credits by arrangement f s

Prerequisites: ST 502 or equivalent, ST 522

Any new advance in the field of statistics which can be presented in lecture series as unique opportunities arise, including (a) theory of sampling applied to survey design and (b) analysis of messy data.

Graduate Faculty, Visiting Professors

ST 694 Seminar 1 (1-0) f s

A maximum of two credits is allowed toward the master's degree, but any number toward the doctorate. Graduate Staff

ST 699 Research credits by arrangement f s

A maximum of nine credits is allowed toward the Master of Science degree; no limitation on credits in doctrate programs. Graduate Staff

EXTENSION PERSONNEL DEVELOPMENT

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

EPD 401 Principles and Methods of Extension Education 3 (3-0) s

Prerequisite: Senior standing (Graduate credit in special cases with permission of committee)

A study of the background, development and operation of the Agricultural Extension Service. Consideration is given to major events leading to the establishment of Agricultural Extension, its objectives, organization and philosophy. Major emphasis is placed upon the principles underlying Extension Education together with methods of program building and teaching.

EPD 452 (PS 452) The Legislative Process 3 (3-0) s

Prerequisites: PS 201 or departmental approval

A study of the formulation of public policy from the institutional and behavioral viewpoints. Important current legislative problems at the congressional and state legislative levels will be selected and will serve as a basis for analyzing the legislative process.

EPD 485 (PS 485) American Political Thought 3 (3-0) s

A study of the evolving currents and crosscurrents of political fault that have helped to shape or to explain the actions of leaders from the puritans to the new frontiersman, from John Winthrop and Roger Williams to John Dewey and J. D. Galbraith.

EPD 501 (SOC 501) Leadership 3 (3-0) f s

Prerequisites: SOC 202, SOC 301 or equivalent

A study of leadership in various fields of American life; analysis of the various factors associated with leadership, with particular attention given to recreational, scientific and executive leadership problems.

EPD 502 (PS 502) Public Administration 3 (3-0) f s

Prerequisite: PS 201 or PS 202 or an acceptable substitute

A study of the principles and problems of administration in a democracy, including such matters as organization, personnel, fiscal management, relationship to the legislative and judicial functions, control of administrative agencies and policies and public relations.

EPD 503 The Programming Process in Cooperative Extension Service and Related Organizations 3 credits f or s

The principles and processes involved in programming, including basic theories and concepts supporting the program process. Attention will be given to the general framework in which programming is done, the organization needed, and the program roles of both professional and lay leaders.

EPD 513 (RS 513) Community Organization 3 (3-0) f

Prerequisite: RS 301

Community organization is viewed as a process of bringing about desirable changes in community life. Community needs and resources available to meet these needs are studied. Democratic processes in community action and principles of commmunity organization are stressed along with techniques and procedures. The roles of leaders, both lay and professional, in community development are analyzed.

EPD 541 (RS 541) Social Systems and Planned Change 3 (3-0) s

Prerequisite: Three hours of Sociology

Study of social agencies and programs and their implementation through specific organizations in dynamic relation with the people whom they serve. Consideration is given to the relation of these agencies and programs to community structure and forces in rural society; coordination of the several types of agencies and programs; professional leadership in the community; and problems of stimulating local leadership and participation.

EPD 559 Principles of Adult and Extension Education 3 credits f or s

Principles involved in Extension Education programs including theories and concepts undergirding and requisite to these programs. Emphasis will be given to the interrelationship of the nature of adult learning, the nature of the subject matter and the setting in which learning occurs. The applicability of relevant principles and pertinent research findings to adult learning will be thoroughly treated.

EPD 590 Topical Problems in Extension Education 1 to 6 f or s

Study and scientific analysis of problems in Extension Education, and preparation of a scholarly research type of paper.

COURSES FOR GRADUATES

EPD 611 (RS 611) Research Methods in Sociology 3 (3-0) f

Prerequisite: Six hours in Sociology

Designed to give the student a mature insight into the nature of scientific research in sociology. Assesses the nature and purpose of research designs, the interrelationship of theory and research, the use of selected techniques and their relation to research designs, and the use of modern tabulation equipment in research.

EPD 691 (PS 691) Applied Principles of Public Administration 2-4 arranged f

Prerequisite: PS 502 or an acceptable substitute

An advanced course in administrative principles and methods. Students

will perform individual or group research, under supervision in specific administrative topics within the context of those public agencies which function in their respective fields of technology.

EPD 632 (RS 632) Rural Family 3 (3-0) f

Prerequisite: Six hours of Sociology

Emphasis is placed on the development of an adequate sociological frame of reference for family analysis; on discovering both the uniquely-cultural and common-human aspects of the family by means of cross-cultural comparisons; on historical explanations for variability in American families with special concern for the rural family; and on analyzing patterns of family stability and effectiveness.

EPD 633 (RS 633) The Rural Community 3 (3-0) s

Prerequisite: Permission of the instructor

The rural community is viewed in sociological perspective as a functional entity. A method of analysis is presented and applied to eight "dimensions," with emphasis on the unique types of understanding to be derived from measuring each dimension. Finally, the effect of change on community integration and development is analyzed.

EPD 690 Seminar in Extension Education 1 credit f

Identification and scientific analysis of major issues and problems relevant to Extension and Adult Education. Credit for this course will involve the active participation of the student in a formal seminar and the scientific appraisal and solution of a selected problem. The course is designed to help the student acquire a broad perspective of issues confronting adult educators and to acquire experience in the scientific analysis and solution of specific issues.

EPD 699 Research in Extension 1 arranged f s

Planning and execution of research, and preparation of manuscript under supervision of graduate committee.

FOOD SCIENCE

COURSES FOR UNDERGRADUATES

FS 301 Food Composition 3 (2-3) f

Prerequisite: CH 220 or CH 221

Basic principles and procedures for the analysis of moisture, ash, carbohydrate, fat and protein contents of foods. Measurement of certain physical characteristics of foods. Mr. Warren

FS 303 (ANS 303) Meat and Meat Products 3 (2-3) s

Prerequisite: CH 351

Study of live animal and carcass relationship, dressing percentages and cut-out values. Slaughtering, cutting, curing, freezing and handling of meat and meat products for commercial and home use. Mr. Blumer

FS 309 (ANS 309) Meat Selection 1 (0-6)·f

Detailed consideration of factors involved in selection of carcasses and wholesale cuts of beef, pork and lamb. Practice in identification of wholesale and retail cuts. Mr. Craig

FS 331 (AGE 331) Food Engineering 3 (2-3) s

Prerequisite: PY 211 or PY 221

Basic engineering principles applicable, wholly or in part, to food processing. Forms of energy and how they can be altered in state, composition, direction of force to fulfill the processing requirements. Latest means of energy conversion to affect efficient and practical applications to power, heat, refrigeration and irradiation. Instruments and controls for processing with applicable principles of fluid flow, heat transfer, air-vapor relationships, filtration, separation and materials handling by mechanical and flotation methods. Mr. Jones

FS 400 Foods and Nutrition 3 (3-0) f

Prerequisite: CH 220

A study of the health of an individual as related to food and the ability of his body to use food. Evaluation of normal diets and factors that promote optimal nutrition throughout life, and the application of biochemistry to utilization of foods. Mr. Aurand

FS 401 Market Milk and Related Products 3 (2-3) f

Principles of processing, distribution and quality control of fluid milk and related products. Mr. Warren

FS 403 Ice Cream and Related Frozen Dairy Foods 3 (2-3) s

Prerequisite: FS 401

Choice, preparation and processing of ingredients and freezing of ice cream and other frozen desserts. Mr. Warren

FS 404 (PO 404) Poultry Products 3 (2-3) f

Prerequisites: CH 101, BS 100

Selection, processing, grading and packaging poultry meat and eggs. Factors involved in preservation of poultry meat and eggs. Mr. Fromm

FS 410 Food Products Evaluation 3 (2-3) s

Prerequisite: ST 361 or equivalent

A comprehensive study of problems encountered in new food product development and consumer acceptance. A study of the nature of sensory responses with emphasis on taste, smell and appearance (color) as related to foods; design and methodology of small and large consumer panel testing; and the application of appropriate mathematical procedures to food acceptance testing and methodology. Mr. Hoover

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

FS 502 Food Chemistry 3 (3-0) f

Prerequisite: CH 220 or CH 221

The basic composition, structure and properties of food, and the chemistry of changes occurring during processing and utilization of the food. Interpret and integrate widely published data in the food field with basic principles of chemistry. Mr. Aurand

FS 503 Food Analysis 3 (1-6) s

Prerequisites: CH 215, CH 351, FS 502

A study of the principles, methods and techniques necessary for quantitative physical and chemical analyses of food and food products. Results of analysis will be studied and evaluated in terms of quality standards and governing regulations. Mr. Aurand

FS 505 (BO 505) Food Microbiology 3 (2-3) s

Prerequisite: BO 412

The relationship of habitat to the occurrence of microorganisms on foods; environmental factors affecting the growth of various microorganisms in foods; microbiological action in relation to food spoilage and food manufacture; physical, chemical and biological destruction of microorganisms in foods; methods for microbiological examination of food stuffs; and public health and sanitation bacteriology. Mr. Speck

FS 506 (BO 506) Advanced Food Microbiology 3 (0-9) f

Prerequisite: FS 505 or consent of instructor

Ecology and physiology of microorganisms important in the manufacture and deterioration of various classes of foods; the identification of representative species of such microorganisms isolated from natural environments; principles of nutrition, symbiosis and bacteriophage activity in culture maintenance for food production. Mr. Speck

FS 521, 522 Technology of Fruit and Vegetable Products 3 (2-2) f s

Prerequisite: BO 412

Comprehensive treatment of principles and methods of preservation of fruits and vegetables, including studies of commercial plant operations, and visits to food processing plants. Mr. Hoover

FS 590 Food Science Seminar 1 (1-0) s

Prerequisites: Senior or graduate standing and consent of instructor

A review and discussion of scientific articles, progress reports in research and special problems of interest. Graduate Staff

FS 591 Special Problems in Food Science 1-3 (arranged) f s

Prerequisites: Senior or graduate standing and consent of instructor

Analysis of scientific, engineering and economic problems of current interest in foods. The scientific appraisal and solution of a selected problem. The problems are designed to provide training and experience in research. Graduate Staff

COURSES FOR GRADUATES ONLY

FS 690 Seminar in Food Science 1 (1-0) f s

Preparation and presentation of scientific papers, progress reports of research and special topics of interest in foods. Graduate Staff

FS 691 Special Research Problems in Food Science credits by arrangement

Directed research in a specialized phase of food science designed to provide experience in research methodology and philosophy. Graduate Staff

FS 699 Research in Food Science credits by arrangement

Original research preparatory to the thesis for the Master of Science or Doctor of Philosophy degrees. Graduate Staff

FORESTRY

COURSES FOR UNDERGRADUATES

FOR 52 Small Private Forest Management 3 (2-3) s

Growing, harvesting and marketing timber products under small private

ownership conditions.
For Agricultural Institute students. Staff

FOR 101 Introduction to Forestry 1 (1-0) f
The profession of forestry, its scope and opportunities; conservation of natural resources. Mr. Preston

FOR 201 Wood Structure and Properties 3 (2-3) s
Identification, structure, properties and uses of woods of economic importance in the United States. This course is a condensation of FOR 202, 203 with less emphasis. Mr. Carter

FOR 202 Wood Structure and Properties I 3 (1-4) f
The macro- and micro-structure of wood is emphasized in this introductory course. As related to wood structure, the physical properties and uses of several commercially important coniferous and deciduous woods are also studied. The techniques of hand lens and microscope identification of wood are covered. Mr. Thomas

FOR 203 Wood Structures and Properties II 3 (2-3) s
Prerequisites: FOR 202, PY 211
Physical properties of wood, specific gravity relationships, wood in relation to moisture, wood in relation to heat, sound, light, electricity, combustion; introduction to strength properties of wood. Mr. Rice

FOR s204 Silviculture 3 credits
Sophomore Summer Camp
Growth and development of forest stands; reproduction counts, type mapping, thinning, and weeding; establishment and measurement of sample plots. Staff

FOR s205 Wood Machining Practicum 1 credit
Sophomore Summer Practicum
Prerequisite: FOR 203
Laboratory exercises in machining of wood. Staff

FOR s206 Wood Drying Practicum 1 credit
Sophomore Summer Practicum
Laboratory exercises in wood drying. Staff

FOR s207 Gluing Practicum 1 credit
Sophomore Summer Practicum
Laboratory exercises in gluing wood and preparation of particle board. Staff

FOR s208 Wood Finishing Practicum 1 credit
Sophomore Summer Practicum
Laboratory exercises in wood finishing. Staff

FOR s209 Plant Inspections 1 credit
Sophomore Summer Practicum
Inspection of wood-using plants. Staff

FOR s210 Mensuration Practicum 2 credits
Sophomore Summer Practicum
Laboratory exercises in mensuration. Staff

FOR s211 Logging and Milling Practicum 2 credits
Sophomore Summer Practicum
Practical exercises in logging and milling. Staff

FOR s212 Graphic Methods 1 credit
Sophomore Summer Practicum
Laboratory exercises in appropriate graphic methods. Staff

FOR 219 Forest Economy and its Operation 3 (2-2) s
Prerequisite: EC 201 or EC 205
Multiple use concept of forestry; economic principles underlying production; investment problems; factors which influence demand for forest products. Mr. Dyson

FOR s264 Protection 3 credits
Sophomore Summer Camp
Protection practices relating to fire, insects and disease. Staff

FOR s274 Mapping and Mensuration 3 credits
Sophomore Summer Camp
Collection of field data for stand and yield tables, stem analysis, timber surveys, basic mensuration, forest mapping. Staff

FOR s284 Utilization 1 credit
Sophomore Summer Camp
Trips to wood industries; expositions on manufacturing processes. Staff

FOR 301 Wood Processes I 4 (3-2) f
Perequisites: FOR 201 or FOR 203, FOR 209
The processes of drying, gluing and finishing wood. Processes of reconstituting wood as fiberboard, hardboard and particle board. Basic requirements of various procedures and materials. Factors in selecting produtions methods. Mr. Carter

FOR 302 Wood Processes II 4 (3-2) s
Prerequisites: FOR 201, FOR 203, FOR 209
The theories and techniques of converting raw wood into usable products by milling, veneering and chipping round wood. Included also is the processing of finished lumber, dimension stock, plywood and other wood products. Mr. Carter

FOR 321, 322 Pulp and Paper Technology 3 (3-0) f s
Brief survey of the physical and chemical characteristics of wood and cellulose. Chemistry and technology of the major mechanical, chemical and semi-chemical processes employed in the manufacture of pulp and paper. Mr. Hitchings

FOR 342 Fiber Analysis 3 (1-4) s
Fiber microscopy; the determination of fiber measurement, quality, variation and identity in pulpwood. Mr. Barefoot

FOR 361, 362 Silvics 3 (2-3) f s
Prerequisite: Summer Camp
Site, soil and other environmental factors in relation to the establishment, growth, and development of seedlings, trees and timber stands; the influence of forest vegetation on site, ground water, and micro-climate.
Messrs. Duffield, Perry

FOR 372 MENSURATION 3 (2-2) s

Prerequisite: FOR s274

The measurement of timber, both standing and felled; log rules form factors, stem analysis; growth; methods of making volume, growth, and stand tables; increment and yield studies; development of stand and yield tables from field data. Mr. Dyson

FOR 403 PAPER PROCESS ANALYSIS 3 (0-6) s

Manufacture of several types of papers with particular attention to stock preparation, sizing, filling and coloring. The finished products are tested physically and chemically and evaluated from the standpoint of quality and in comparison with the commercial products they are intended to duplicate. Mr. Hitchings

FOR 404 MANAGEMENT ANALYSIS 3 (1-6) s

Application of management, logging, silvicultural and utilization practices on assigned areas. Each student must make a forest survey of an individual area and submit a record. Mr. Bryant

FOR 405 FOREST INVENTORY 3 (1-6) s

Timber estimating and data compilation. Mr. Bryant

FOR 411, 412 PULP AND PAPER UNIT PROCESSES 3 (3-0) f s

Principles of operation, construction and design of process equipment employed in the pulp and paper industry. Mr. Cook

FOR 413 PAPER PROPERTIES AND ADDITIVES 4 (1-9) f

Physical, chemical and microscopical examination of experimental and commercial papers and evaluation of the results in terms of the utility of the product tested; evaluation and identification of dyestuffs and the development of color formulas. Messrs. Cook, Landes

FOR 422 FOREST PRODUCTS 3 (3-0) f

Prerequisites: FOR 201, CH 203 or CH 426

The source and method of obtaining derived and manufactured forest products other than lumber. Mr. Carter

FOR 423 LOGGING AND MILLING 3 (2-3) f

Timber harvesting and transportation methods, equipment and costs; safety and supervision; manufacturing methods; log and lumber grades. Mr. Barefoot

FOR 432 MERCHANDISING FOREST PRODUCTS 2 (2-0) f

Principles and practices in the distribution and marketing of the products obtained from wood; organization and operation of retail, concentration and wholesale outlets. Mr. Carter

FOR 434 WOOD OPERATIONS I 3 (2-3) f

Prerequisites: FOR 301, FOR 302

Organization of manufacturing plants producing wood products including company organization, plant layout, production planning and control. Analysis of typical manufacturing operations in terms of processes, equipment, size and product specification. The organization and operation of Wood Products markets. Mr. Barefoot

FOR 435 WOOD OPERATIONS II 3 (2-3) s

Prerequisites: FOR 301, FOR 302

The application of the techniques of operations analysis to management decision making in the wood products field. Choice of products to manu-

facture. Allocation of production resources. Development of product distribution systems. Mr. Barefoot

FOR 441 Design of Wood Structures 3 (2-3) s

Prerequisite: EM 341

Strength and related properties of commercial woods; standard A.S.T.M. strength tests; toughness; timber fastening; design of columns; simple, laminated and box beams; trusses and arches. Mr. Jayne

FOR 444 Introduction to Quality Control 3 (2-3) s

Prerequisite: ST 361

A study of methods used to control quality of manufactured wood products. Control charts of variable and attributes. Acceptance sampling techniques. Mr. Barefoot

FOR 461 Paper Converting 1 (1-0) s

A survey of the principal processes by which paper and paper board are fabricated into the utilitarian products of everyday use. Mr. Landes

FOR 462 Artificial Forestation 2 (1-3) s

Production collection, extraction, and storage of forest tree seeds; nursery practice; field methods of planting. Mr. Duffield

FOR 463 Plant Inspections 1 (0-3) s

One week inspection trips covering representative manufactures of pulp and paper and paper-making equipment. Staff

FOR 471 Pulping Process Analysis 4 (1-9) f

Preparation and evaluation of the several types of wood pulp. The influence of the various pulping and bleaching variables on pulp quality are studied experimentally and these data evaluated critically.

Mr. Hitchings

FOR 481 Pulping Processes and Products 2 (2-0) s

Prerequisites: FOR 202, CH 203 or CH 221

Fiber manufacturing process and equipment; wall, insulation and container board products; manufacture of roofing felts; pulp products manufacturing; resin treated and specialty products, lignin and wood sugar products. Mr. Landes

FOR 482 Pulp and Paper Mill Management 2 (2-0) s

A survey of the economics of the pulp and paper industry is followed by a study of the work of the several departments of a paper mill organization and the functions of the executives who administer them. Mr. Cook

FOR 491 Senior Problems credits arranged

Problems selected with faculty approval in the areas of management or technology. Staff

FOR 492 Senior Problems credits arranged

Problems selected with faculty approval in the areas of mangement or technology. Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

FOR 511 Silviculture 3 (3-0) s

Prerequisites: FOR 361, BO 421

The principle and application of intermediate and reproductive methods of cutting; controlled burning, silvicides and other methods of hardwood

control. The application of silvicultural methods in the forests of the United States. Mr. Duffield

FOR 512 Forest Economics 3 (3-0) f

Prerequisites: FOR 372, EC 201

Economics and social value of forests; supply of, and demands for forest products; land use; forestry as a private and a public enterprise; economics of the forest industries. Mr. Lammi

FOR 513 Tropical Woods 2 (1-3) s

Prerequisites: FOR 203, FOR 301

Structure, identification, properties, characteristics and use of tropical woods, especially those used in plywood and furniture. Mr. Barefoot

FOR 521, 522 Chemistry of Wood and Wood Products 3 (2-3) f s

Prerequisites: FOR 202, CH 215, CH 426, PY 212

Fundamental chemistry and physics of wood and wood components; pulping principles; electrical and thermal properties. Mr. Stamm

FOR 531 Forest Management 3 (2-3) f

Prerequisite: FOR 372

Corequisite: FOR 511

Management of timber lands for economic returns; the normal forest taken as the ideal; the application of regulation methods to the forest. Mr. Bryant

FOR 532 Forest Management 3 (3-0) s

Continuation of FOR 531.

FOR 533 Advanced Wood Structure and Identification 2 (1-3) f

Prerequisite: FOR 202

Advanced microscopic identification of the commercial woods of the United States and some tropical woods; microscopic anatomical features and laboratory techniques. Mr. Barefoot

FOR 553 Forest Photogrammetry 2 (1-3) s

Prerequisites: FOR 372, FOR 531

Interpretation of aerial photographs, determination of density of timber stands and area mapping. Mr. Lammi

FOR 571 Advanced Forest Mensuration 3 (2-2) f

Prerequisites: ST 311, FOR 372

Study of cyclical variation in growth of individual trees and stands; analysis of stand structures in even-aged versus all-age stands; general concepts of growing stock levels on yields; evaluation of growth prediction methods. Messrs. Bryant, Maki

FOR 572 Forest Policy 3 (3-0) f

Prerequisites: EC 201, FOR 219

Corequisite: FOR 531

Analysis of the forest policies of the United States and selected foreign countries; criteria for their evaluation; appraisal of current policies and alternatives. Mr. Lammi

FOR 591 Forestry Problems credits arranged

Prerequisite: Senior or graduate standing

Assigned or selected problems in the field of silviculture, logging, lumber manufacturing, pulp technology, or forest management. Staff

FOR 599 METHODS OF RESEARCH IN FORESTRY credits arranged

Prerequisite: Senior or graduate standing

Research procedures, problem outlines, presentation of results; consideration of selected studies by forest research organizations; sample plot technique.

Staff

COURSES FOR GRADUATES ONLY

FOR 603 TECHNOLOGY OF WOOD ADHESIVES 3 (3-0) f or s

Prerequisites: CH 425, CH 426, FOR 433

The fundamentals of adhesives as applied to wood-to-wood and wood-to-metal bonding. Technology of adhesives. Preparation and use of organic adhesives. Testing of adhesives and evaluation of quality of adhesives and bonded joints.

Mr. Hart

FOR 604 TIMBER PHYSICS 3 (3-0) f or s

Prerequisite: FOR 441

Density, specific gravity and moisture content variation affecting physical properties; physics of drying at high and low temperatures; thermal, sound, light and electrical properties of wood.

Messrs. Ellwood, Hart

FOR 605 DESIGN AND CONTROL OF WOOD PROCESSES 3 (3-0) f or s

Prerequisite: FOR 604

Design and operational control of equipment for processing wood.

Mr. Ellwood

FOR 606 WOOD PROCESSES ANALYSIS 3 (3-0) f

Prerequisites: FOR 512, FOR 604

Analysis of wood processes through the solution of comprehensive problems involving the physics of temperature and moisture relations.

Mr. Ellwood

FOR 607 ADVANCED QUALITY CONTROL 3 (3-0) s

Prerequisites: FOR 606, ST 515

Advanced statistical quality control as applied to wood processing.

Mr. Hart

FOR 611 FOREST GENETICS 3 (3-0) f or s

Prerequisites: GN 411, permission of instructor

Application of genetic principles to silviculture, management and pulp utilization. Emphasis is on variations in wild populations, on the bases for selection of desirable qualities and on fundamentals of controlled breeding.

Mr. Zobel

FOR 691 GRADUATE SEMINAR 1 (1-0) f or s

Prerequisite: Graduate standing in Forestry or closely allied fields

Presentation and discussion of progress reports on research, special problems and outstanding publications in forestry and related fields.

Graduate Staff

FOR 692 ADVANCED FOREST MANAGEMENT PROBLEMS credits arranged

Prerequisite: Graduate standing

Directed studies in forest management.

Graduate Staff

FOR 693 ADVANCED WOOD TECHNOLOGY PROBLEMS credits arranged

Prerequisite: Graduate standing

Specific forestry problems that will furnish material for a thesis.

Graduate Staff

FOR 699 Problems in Research credits arranged
Prerequisite: Graduate standing
Specific forestry problems that will furnish material for a thesis.
Graduate Staff

GENETICS

COURSES FOR UNDERGRADUATES

GN 301 Genetics in Human Affairs 3 (3-0) f s
Fundamental principles of genetics will be presented at a level not requiring prerequisite courses in biological sciences but sufficient for an understanding of the relation of genetics to society and technology. A survey will be given of current knowledge of inheritance of human traits. Topics discussed include human evolution, racial differences, and possibilities of controlling the heredity of man.
Mr. Bostian

COURSES FOR ADVANCED UNDERGRADUATES

GN 411 The Principles of Genetics 3 (2-2) f s
Prerequisites: BS 100
An introductory course. The physical and chemical basis of inheritance; genes as units of structure and function; qualitative and quantitative aspects of genetic variation. Mr. Bostian

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

GN 503 (ANS 503) Genetic Improvement of Livestock 3 (2-3) f

GN 512 Genetics 4 (3-2) f
Prerequisite: GN 411
Intended for students desiring more thorough and detailed training in fundamental genetics with some attention to physiological aspects. (Students conduct individual laboratory problems.) Mr. Grosch

GN 513 Cytogenetics I 4 (3-2) f
Prerequisite: GN 512 or consent of instructor
The chromosomes as vehicles of heredity. Mitosis and meiosis as bases of genetic stability and recombination. Structural and numerical aberrations and their effect upon the breeding systems of plants and animals. Interspecific hybrids and polyploids. Lectures and laboratory.
Messrs. Galletta, Gerstel

GN 532 Biological Effects of Radiations 3 (3-0) s
Prerequisite: ZO 103 or consent of instructor
Qualitative and quantitative effects of radiations (other than the visible spectrum) on biological systems, to include both morphological and physiological aspects in a consideration of genetics, cytology, histology, and morphogenesis. Mr. Grosch

GN 540 Evolution 3 (3-0) f
Prerequisite: GN 411
The facts and theories of evolution in plants and animals. The causes and consequences of organic diversity.
(Offered in 1964-65 and alternate years.) Mr. Smith

GN 541 (CS 541, MS 541) Plant Breeding Methods 3 (3-0) f

GN 542 (CS 542, HS 542) Plant Breeding Field Procedures 2 (0-4) summer

GN 550 Experimental Evolution 3 (3-0) s

Prerequisites: GN 512, and either GN 513 or consent of instructor

Experimental evolution deals primarily with micro-evolutionary processes examined at the inter- and intra-specific population level. A review of the results from experimental population studies and analyses of natural populations concerning variation patterns and adaptation, natural selection, polymorphism, introgression, population breeding structure, isolating mechanisms, etc., is made and interpreted in relation to Neo-Darwinian concepts of the origin of species. Mr. Mettler

GN 561 (BO 561) Biochemical and Microbial Genetics 3 (3-0) f

The course will cover the development of the fields of biochemical genetics and microbial genetics and will emphasize both the techniques and concepts utilized in research currently being carried out in these areas.

Mr. Armstrong

COURSES FOR GRADUATES ONLY

GN 602 (AS 602) Population Genetics in Animal Improvement 3 (3-0) f

GN 607 (PP 607) Genetics of Fungi 3 (3-0) f

Prerequisites: GN 513 or graduate standing in Botany and Zoology

Review of major contributions in fungus genetics with emphasis on principles and theories that have evolved in recent developments. (Offered in 1964-65 and alternate years.)

Mr. Nelson

GN 611 (FOR 611) Forest Genetics 3 (3-0) s

GN 613 (CS 613, HS 613) Plant Breeding Theory 3 (3-0) s

GN 626 (ST 626) Statistical Concepts in Genetics 3 (3-0) s

GN 631 Mathematical Genetics 3 (3-0) f

Prerequisites: GN 512, ST 511 or consent of instructor

History of mathematical biology, role of mathematical concepts in the development of genetic science, theory of genetic recombination, dynamics of genetic population.

Mr. Kojima

GN 633 Physiological Genetics 3 (3-0) s

Prerequisite: GN 512

Recent advances in physiological genetics. Attention will be directed to literature on the nature and action of genes, and to the interaction of heredity and environment in the expression of the characteristics of organisms. Mr. Grosch

GN 641 Colloquium in Genetics 2 (2-0) f s

Prerequisites: Graduate standing, consent of instructor

Informal group discussion of prepared topics assigned by instructor.

Graduate Staff

GN 691 Seminar 1 (1-0) f s
Prerequisite: Graduate standing

GN 695 Special Problems in Genetics 1 to 3 f s
Prerequisites: Advanced graduate standing and consent of instructor
Special topics designed for additional experience and research training.
Graduate Staff

GN 699 Research arranged
Prerequisite: Graduate standing
Original research related to the student's thesis problem. A maximum of six credits for the master's degree; by arrangement for the doctorate.
Graduate Staff

GEOLOGICAL ENGINEERING

COURSES FOR UNDERGRADUATES

MIG 101 Earth Science 3 (3-0) s
Elective; not to be taken after MIG 120.
Introductory course in General Geology; changes in the earth, and underlying physical and life processes.

MIG 120 Physical Geology 3 (2-3) f s
Dynamic processes acting on and within the earth; materials and makeup of the earth's crust; emphasis on engineering and agricultural applications in the southeast. Lectures, laboratories and field trips.

MIG 208 Physical Geography and Meteorology 3 (2-3) s
Study of the physical conditions on the earth's surface that influence human activities; factors of man's environment, including planetary conditions, geographic location, climate and weather, soils, and land forms.

MIG 220 Physical-Historical Geology 4 (3-3) f
Prerequisite: CH 101
A broad introductory survey of earth materials, processes, and history. Common minerals and rocks. Effect of solar, gravitational, chemical, and internal thermal energy in transforming crustal constitution, structure, position, and surface form. Measurement and subdivision of geologic time. The time scale. Geosynclinal and tectonic cycles. Typical major geologic events in North America. Evolution of the main fossil groups.

MIG 222 Historical Geology 3 (2-3) s
Prerequisite: MIG 120
Chronologic account of the geologic events during the development of the earth's crust, mainly in North America. Evolution and environmental significance of the principal fossil animal and plant groups.

MIG 323 Paleontology 3 (2-3) f s
Prerequisite: MIG 220 or MIG 222
Study of fossil life forms, with major emphasis on classification and structure of the invertebrate animals and their application to problems of correlation of strata. Lecture, laboratories and field trips.

MIG 331 Crystallography and Optical Microscopy 4 (2-4) f

Prerequisites: CH 103, PY 202

The crystalline state, elements of morphologic crystallography, space lattice structure, and crystal chemistry. Crystal symmetry, systems, classes, and common forms. Atomic and ionic packing, coordination number, polymorphism, isomorphism, twinning, zoning, exsolution and replacement effects. Techniques and underlying optical theory for identifying minerals with the polarizing microscope. Determination of index of refraction and birefringence; isotopic, uniaxial, or biaxial character; optic angle, sign, and orientation. Adjunct apparatus for statistical and petrographic studies.

MIG 351 Tectonic Structures 3 (2-3) f

Prerequisite: MIG 120 or MIG 220

Applications of the principles of mechanics to an understanding of rock deformation. Analysis of fracture, solid flow, and fluid flow structures imposed on igneous, sedimentary and metamorphic rock masses by internal crustal forces and gravitational movements. Stress-strain relations of rocks and minerals under surface conditions, and the modification of behavior which result from pore solutions and increase of confining pressure, temperature, and time.

MIG 415 Mineral Exploration and Evaluation 3 (2-3) s

Prerequisites: MIG 440, MIG 452

Application of the principles of geology, geophysics, and geochemistry to the discovery and evaluation of mineral deposits. Design of mineral exploration and development programs based on knowledge of the unique thermodynamic, geochemical, and tectonic features that control mineral formation and concentrations in well known mining districts, especially those yielding ferrous, base, and precious metals. Review of economic and technological factors governing the value of mineral deposits.

MIG 440 Endogenic Materials and Processes 4 (3-3) s

Prerequisites: MIG 120 or MIG 220, MIG 331

Minerals, rocks and mineral deposits that are formed at high temperatures and pressures by crystallization or solidification of molten magma, or by solid state recrystallization of older rocks. Application of principles of thermodynamics and of phase-rule chemistry, and the results of modern high pressure-temperature laboratory research on the stability fields of crystalline phases, to an understanding of igneous and metamorphic rocks. Identification, classification, occurrence, origin, and economic value of the principal igneous and metamorphic rocks.

MIG 452 Exogenic Materials and Processes 4 (3-3) f

Prerequisites: MIG 120 or MIG 220, MIG 331

Identification, classification, geologic occurrence, origin and economic value of minerals, rocks, and mineral deposits formed by physical, chemical, and biological processes at low temperatures and pressures at and near the earth's surface. Hydrodynamics of sediment transport and deposition, settling velocities and size sorting, chemical and biochemical precipitation from aqueous solutions. Principles of division of stratified terranes into natural units, correlation of strata, identification of depositional environments, and facies analysis.

MIG 461 Engineering Geology 3 (3-0) f

Prerequisite: MIG 120 or MIG 220

The application of geologic principles to engineering practice; analysis of geologic factors and processes affecting specific engineering projects.

MIG 462 Geological Surveying 3 (1-6) s

Prerequisites: MIG 351, MIG 440, MIG 452

Methods of field observation and use of geologic surveying instruments in surface and underground work; representation of geologic features by maps, sections and diagrams. Lectures, laboratories and field work.

MIG 465 Geological Field Procedures 6 summer

A six week summer field course. Practical field procedures and instruments commonly used to procure geologic data for evaluating mineral deposits, solving engineering problems involving earth materials, and drawing scientific conclusions. Observation of geologic phenomena in their natural setting. Large and intermediate scale geologic mapping of surface features and large scale mapping underground in mine workings.

MIG 472 Elements of Mining Engineering 3 (2-3) f

Prerequisites: MIG 120 or MIG 220 and at least junior standing in Geological Engineering

Introduction to mining; surface and underground methods of development and production; explosives, drilling and blasting; ore loading, transport, and hoisting; drainage and ventilation; mine surveying and sampling; fire assaying; mining law, organization, administration and safety. Lectures, laboratory and field inspections.

MIG 491, 492 Senior Seminar 1 to 3 f s

Reports and discussion of geological topics of current interest, with attention to methodology, bibliography, and research techniques.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

MIG 522 Petroleum Geology 3 (3-0) s

Prerequisite: MIG 452

Properties, origin and modes of occurrence of petroleum and natural gas. Geologic and economic features of the principal oil and gas fields, mainly in the United States.
(Offered in 1965-66 and alternate years.)

MIG 552 Exploratory Geophysics 3 (2-3) s

Prerequisites: MIG 351, PY 202

Fundamental principles underlying all geophysical methods; procedure and instruments involved in gravitational, magnetic, seismic, electrical, and other methods of studying geological structures and conditions. Spontaneous potential, resistivity, radioactivity, temperature, and other geophysical logging methods. Study of applications and interpretations of results.

MIG 563 Applied Sedimentology 3 (3-0) s

Prerequisite: MIG 452

An advanced treatment of the geological aspects of erosion and sediment transport and deposition, especially as related to engineering works, and to land and water resource utilization. Analysis of physical, mineralogical, and some chemical properties of sediments and sedimentary rocks, interpretation of these properties in terms of depositional basins and environments.
(Offered in 1964-65 and alternate years.)

MIG 565 Hydrogeology 3 (3-0) f

Prerequisite: MIG 452

Occurrence and sources of surface and subsurface water. Relationships of surface water to subsurface water. Rock properties affecting infiltration,

movement, lateral and vertical distribution, and quality of ground water. Determination of permeability, capacity, specific yield, and other hydraulic characteristics of aquifers. Principles of well field design, legal aspects of water supplies.
(Offered in 1965-66 and alternate years.)

MIG 567 Geochemistry 3 (3-0) f
Prerequisite: CH 231 or CH 433

The quantitative distribution of elements in the earth's crust, the hydrosphere, and the atmosphere. Application of the laws of chemical equilibrium and resultant chemical reactions to natural earth systems. Geochemical application of Eh-pH diagrams. Geochemical cycles. Isotope geochemistry. (Offered in 1964-65 and alternate years.)

MIG 571, 572 Mining and Mineral Dressing 3 (2-3) f s
Prerequisite: MIG 472

Principles of the mineral industry; mining laws, prospecting, sampling, development, drilling, blasting, handling, ventilation and safety; administration; surveying, assaying; preparation, beneficiation and marketing.

MIG 581 Geomorphology 3 (2-3) f
Prerequisite: MIG 452

A systematic study of land forms and their relations to processes, stages of development, and adjustment to underlying structure. Lectures, map interpretations, and field trips.

MIG 593 Advanced Topics in Geological Engineering 1 to 6
Prerequisite: Permission of staff

Special study of some advanced phases of geological engineering.

COURSES FOR GRADUATES ONLY

MIG 611, 612 Advanced Economic Geology 3 (3-0) f s
Prerequisites: MIG 440, MIG 452

Detailed study of the origin and occurrence of specific mineral deposits. Regional correlations. (Offered in 1964-65 and alternate years.)

MIG 632 Microscopic Determination of Opaque Minerals 3 (0-6) s
Prerequisite: MIG 331

Identification of metallic, opaque minerals in polished sections by physical properties, etch reactions and microchemical tests. Laboratories.

MIG 642 Advanced Petrography 3 (1-4) s
Prerequisites: MIG 331, MIG 440

Application of the petrographic microscope to the systematic study of the composition and origin of rocks; emphasis on igneous and metamorphic rocks.

MIG 695 Seminar 1 (1-0) f s
Prerequisite: Graduate standing

Scientific articles, progress reports and special problems of interest to geologists and geological engineers discussed.

MIG 699 Geological Research 3 or 6
Prerequisite: Permission of instructor

Lectures, reading assignments, and reports; special work in Geology to meet the needs and interests of the students. Thesis problems.

HISTORY

COURSES FOR UNDERGRADUATES

HI 201 The Ancient World 2 (2-0) f

HI 202 The Medieval World 2 (2-0) s

HI 205 The Modern Western World 3 (3-0) f s
Not open to students in the School of Liberal Arts.

HI 245, 246 History of European Civilization 3 (3-0) f s

HI 251 The United States Through Reconstruction 3 (3-0) f s

HI 252 The United States Since Reconstruction 3 (3-0) f s

HI 261 The United States in Western Civilization 3 (3-0) f s
Not open to students in the School of Liberal Arts.

HI 306 North Carolina History 2 (2-0) f s

HI 321 International Relations Since 1870 3 (3-0) f
Prerequisite: Three hours of History or departmental approval
(Fall 1964 and alternate years.)

HI 327 Renaissance and Reformation 3 (3-0) f
Prerequisite: Three hours of History or departmental approval
(Fall 1964 and alternate years.)

HI 328 Age of Absolutism in Europe, 1603-1789 3 (3-0) s
Prerequisite: Three hours of History or departmental approval
(Spring 1965 and alternate years.)

HI 329 Revolutionary Europe, 1789-1815 3 (3-0) f
Prerequisite: Three hours of History or departmental approval
(Fall 1965 and alternate years.)

HI 330 Europe: Vienna to Versailles 3 (3-0) s
Prerequisite: Three hours of History or departmental approval
(Spring 1966 and alternate years.)

HI 331 Europe Since 1918 3 (3-0) s
Prerequisite: Three hours of History or departmental approval
(Spring 1965 and alternate years.)

HI 341 History of Technology 3 (3-0) f

HI 343 Colonial America 3 (3-0) f
Prerequisite: Three hours of History or departmental approval
(Fall 1964 and alternate years.)

HI 344 The United States: Revolution to Constitution 3 (3-0) f
Prerequisite: Three hours of History or departmental approval
(Fall 1965 and alternate years.)

HI 346 The United States: The Middle Period, 1815-1850 3 (3-0) s
Prerequisite: Three hours of History or departmental approval
(Spring 1965 and alternate years.)

HI 348 Emergence of Modern America 3 (3-0) f
Prerequisite: Three hours of History or departmental approval
(Fall 1964 and alternate years.)

HI 351, 352 English History 3 (3-0) f s
Prerequisite: Three hours of History or departmental approval
The semesters divide at 1688 and may be taken separately.

HI 355 British Empire and Commonwealth 3 (3-0) s
Prerequisite: Three hours of History or departmental approval
(Spring 1966 and alternate years.)

HI 375 Latin America 3 (3-0) f
Prerequisite: Three hours of History or departmental approval
(Fall 1964 and alternate years.)

HI 401 Russian History 3 (3-0) f
Prerequisite: Three hours of History or departmental approval
(Fall 1965 and alternate years.)

HI 404 Asia and the West 3 (3-0) s
Prerequisite: Three hours of History or departmental approval
(Spring 1966 and alternate years.)

HI 407 France Since the Revolution 3 (3-0) f
Prerequisite: Three hours of History or departmental approval
(Fall 1965 and alternate years.)

HI 412 Recent United States History 3 (3-0) f s
Prerequisite: Three hours of History or departmental approval

HI 413 United States Foreign Relations Since 1898 3 (3-0) f
Prerequisite: Three hours of History or departmental approval
(Fall 1964 and alternate years.)

HI 422 History of Science 3 (3-0) f s
Prerequisite: Three hours of History or departmental approval

HI 424 American Intellectual History 3 (3-0) s
Prerequisite: Three hours of History or departmental approval
(Spring 1965 and alternate years.)

HI 427 European Intellectual History Since 1800 3 (3-0) f
Prerequisite: Three hours of History or departmental approval
(Fall 1965 and alternate years.)

HI 462 (ED 462) History of Education 3 (3-0) s
Prerequisite: Three hours of History or departmental approval

HI 491, 492 Seminar in History 3 (3-0) f s
Required of seniors majoring or concentrating in History; open to other seniors and graduate students with departmental permission.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

HI 534 (RS 534) Agricultural Organizations and Movements 3 (3-0) s
Prerequisite: Three credits in American history, American government, sociology or a related social science

HORTICULTURAL SCIENCE

COURSES FOR UNDERGRADUATES

HS 201 Principles of Horticulture 3 (3-0) f s

Attention will be directed to the basic principles involved in the application of these principles to the production, processing and utilization of fruit, vegetable, and ornamental crops. Attention will also be given to the economic importance and distribution of horticultural enterprises.

Mr. Gardner

HS 211, 212 Ornamental Plants 3 (1-5) f s

Prerequisite: BS 100

Distribution, botanical characters and relationships, adaptation and usage of ornamental trees, shrubs, vines, and herbaceous plants. Staff

HS 301 Plant Propagation 3 (2-2) s

Prerequisite: BS 100

A study of principles, methods, and practices in seedage, cuttage, division, budding, grafting, and other methods of propagation. Consideration will also be given to scion and stock relationships and dormancy. Staff

HS 342 Landscape Gardening 3 (2-3) f

The application of the principles of design to the landscaping of small properties and the selecting and planting of trees, shrubs, flowers, and lawn grasses. Students will be required to work out detailed landscape plans. Visitations will be made to outstanding homes and gardens.

Staff

HS 411 Nursery Management 3 (2-3) f

Prerequisites: BS 100, SSC 200

The principles and practices involved in the production, management, and marketing of field-grown and container-grown nursery plants. Field trips will be taken. (Offered in fall 1966 and alternate years thereafter.)

Mr. Cannon

HS 421 Fruit Production 3 (2-3) f

Prerequisites: BS 100, SSC 200

A study of identification, adaptation, and methods of production and marketing of the principal trees and small fruits. Modern practices as related to selection of sites, nutritional requirements, management practices, and marketing procedures will be discussed. Mr. Correll

HS 432 Vegetation Production 3 (2-3) f

Prerequisites: BS 100, SSC 200

A study of the origin, importance, distribution, botanical relationships, and principles of production and marketing of the major vegetable crops.

Mr. Miller

HS 441 Floriculture I 3 (2-3) f

Prerequisites: BS 100, SSC 200

The scope and importance of the commercial flower industry; the basic principles and practices involved in the production and marketing of flowers grown in the greenhouse and in the field. (Offered in fall 1965 and alternate years.)

HS 442 Floriculture II 3 (2-3) s

Prerequisites: BS 103, SSC 200

Principles and methods of production of commercial flower crops in the

greenhouse and in the field, including fertilization, moisture, temperature, and light relationships, insect and disease control, and marketing of cut flowers and pot plants. (Offered in spring 1966 and alternate years thereafter.)

Mr. Larson

HS 471 Arboriculture 3 (2-3) s

Prerequisites: BS 103, SSC 200

A study of the principles and practices in the care and maintenance of ornamental trees and shrubs, such as pruning, fertilization, control of insects and diseases, and tree surgery. Field trips will be taken. (Offered in spring 1965 and alternate years thereafter.)

Mr. Cannon

HS 481 Breeding of Horticultural Plants 3 (2-2) f

Prerequisite: GN 411

The application of genetic and other biological sciences to the improvement of horticultural crops. Mr. Henderson

HS 491 Senior Seminar 1 (1-0) f s

Prerequisite: Senior standing in Horticulture

Presentation of scientific articles, progress reports in research, and special problems in horticulture and related fields. Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

HS 541 (GN 541, CS 541) Plant Breeding Methods 3 (3-0) f

Prerequisite: GN 512, ST 511 recommended

An advanced study of methods of plant breeding as related to principles and concepts of inheritance. Messrs. Haynes, Timothy

HS 542 (GN 542, CS 542) Plant Breeding Field Procedures 2 (0-4) summer

Prerequisite: HS 541 or CS 541 or GN 541

Laboratory and field study of the application of various plant breeding techniques and methods used in the improvement of economic plants.

Messrs. Harvey, Haynes

HS 552 Growth of Horticultural Plants 3 (2-3) s

Prerequisite: BO 421

A study of the effect of nutrient elements, water, light, temperature, and growth substances on horticultural plants. Graduate Staff

HS 562 Post-Harvest Physiology 3 (3-0) s

Prerequisite: BO 421

A study of chemical and physiological changes that occur during handling, transportation, and storage which affect the quality of horticultural crops. Consideration will be given to pre- and post-harvest conditions which influence these changes. Messrs. Ballinger, McCombs

HS 599 Research Principles credits by arrangement

Prerequisite: Permission of instructor

Investigation of a problem in horticulture under the direction of the instructor. The students obtain practice in experimental techniques and procedures, critical review of literature and scientific writing. The problem may last one or two semesters. Credits will be determined by the nature of the problem, not to exceed a total of four hours. Graduate Staff

COURSES FOR GRADUATES ONLY

HS 621 Methods and Evaluation of Horticultural Research 3 (3-0) f

Prerequisite: Graduate standing

Principles and methods of research in the field of horticulture and their application to the solution of current problems. Critical study and evaluation of scientific publications. Compilation, organization, and presentation of data. Mr. Cochran

HS 691 Seminar 1 (1-0) f s

Prerequisite: Graduate standing

Presentation of scientific articles and special lectures. Students will be required to present one or more papers. Attendance of all graduate students is required. Graduate Staff

HS 699 Research credits by arrangement

Prerequisites: Graduate standing in Horticulture, consent of chairman

Original research on specific problems in fruit, vegetable, and ornamental crops. Thesis prepared should be worthy of publication. A maximum of six credits is allowed toward the Master of Science degree; no limitation on credits in doctorate program. Graduate Staff

INDUSTRIAL ARTS

COURSES FOR UNDERGRADUATES

IA 100 Introduction to Industrial Arts 1 (1-0) f

A basic course designed to orient the student to college life and to introduce him to the philosophy, objectives, and scope of industrial arts as related to teacher education and industrial employment. A study of the problems and opportunities in the profession. Staff

IA 102 Fundamentals of Materials and Processes 4 (2-4) f s

A systematic study of the structure and characteristics of selected materials and the processes utilized in shaping, forming, cutting, machining and finishing them into products. Attention will be given to the requirements of manufacturing of products. Experiences in graphic communication, demonstrations of hand and machine tools, and student participation in laboratory problems in the identification and testing of materials will be provided. Staff

IA 103 Drafting I 3 (1-4) s

Service course for Agricultural Education.

Graphical communication encompassing sketching and instrument drawing. Theory and practice taught through the medium of freehand sketching involving oblique, isometric, perspective, exploded, assembly, sections, and orthographic projection type drawings. Also included is blackboard sketching. Mr. Troxler

IA 105 Drafting (Offered 1964-65 only) 4 (2-4) f s

Prerequisites: IA 102, IA 103

This course covers theory and practice in the area of technical communication through the sketching and drafting medium. The student will get practice in both sketching and instrument drawing in the orthographic projection, pictorial drawing, sections, revolutions, and sheet metal development. Mr. Troxler

IA 109 Wood Processing (Offered 1964-65 only) 4 (2-4) f s

Prerequisite: IA 102

This course is designed to provide an orientation to the processes of designing, developing and producing wood products through lectures, discussions and planned experiences in the various woodworking areas. Emphasis will be on planning and developing of wood products in the industrial arts laboratory, together with an analysis of typical products and industrial practices. A research report will be required. Mr. Finch

IA 203 Technical Sketching 2 (1-2) s

Required of students in Furniture Manufacturing.

The application of drawing practices for the layman. Freehand sketching and instrument drawing, lettering, pictorial representation, production sketches, template drawing, exploded views, shades and shadows. Individual problems and selected graphic representation. Mr. Troxler

IA 205 Industrial Arts Design (Offered 1964-65 only) 3 (1-4) f s

Prerequisites: IA 105, IA 109, IA 210

A study of design as related to industry and the industrial arts laboratory. Creative design and individual expression through problems involving the utilization of industrial material for human needs. Mr. Troxler

IA 210 Metal Technology (Offered 1964-65 only) 4 (2-4) f s

Prerequisites: IA 102, IA 105

This course is designed to provide an orientation to the processes of designing, developing and producing metal products. Instruction will be given through lectures, discussions, and planned experiences in the basic metalworking areas. Emphasis will be on planning and developing of metal products in the industrial arts laboratory, coupled with analysis of typical products and industrial practices. A research report will be required. Mr. Moeller

IA 215 Sheet Metal 1 (0-2) s

A course designed to provide practical experiences in the use of tools, materials and processes involved in basic sheet metal fabrication. Mr. Moeller

IA 230 House Planning and Construction 3 (1-4) s
(Offered 1964-65 only.)

Prerequisite: IA 105

This is a depth course in drawing. The student will have laboratory exercises in problem solutions through the drawing method. The skill of application and utilization of drawing as a means of communication will be emphasized. Mr. Troxler

IA 304 General Shop Organization 2 (1-2) s

Prerequisites: IA 105, IA 109, IA 210, IA 312

Application of principles of general shop organization and operation. Analysis of products. Methods, techniques of production of laboratory projects including a variety of materials suitable to varying educational levels. Mr. Troxler

IA 306 Graphic Arts (Offered 1964-65 only) 4 (2-4) s

Prerequisite: IA 102

An introduction to the basic printing areas of letterpress, offset, photography, silk screen, and bookbinding with emphasis on course outline and subject matter for the secondary schools. Mr. Moeller

IA 310 Machine and Foundry Practicum 3 (1-4) f or s
(Offered 1964-65 only)

Prerequisite: IA 210

This course is designed to provide advanced experiences in individual and small group metal founding and machining problems. Emphasis will be

given to the continuity of processes involving pattern making, castings, and operation of the engine lathe, mill and shaper. Attention will be given to planning and precision of construction. Mr. Moeller

IA 311 Metal Fabrication 3 (1-4) f or s

Prerequisites: IA 105, IA 210

This course is designed to provide advanced experiences in individual and small group problems in sheet metal, welding, and associated areas. Emphasis will be given to development, layout, and construction of products in the selected areas with a degree of precision.

Mr. Moeller

IA 312 Electricity-Electronics (Offered 1964-65 only) 4 (3-3) f or s

Prerequisites: PY 211, PY 212 or permission of instructor

A study of the principles of electricity and electronics; basic principles; AC and DC circuits; electrical machinery; and electronics, including power supplies, amplifiers, oscillators, and tuned circuits. Applications and examples of the common experiences which the student encounters such as power and light circuits, motors and controls, measuring and servicing instruments, power supplies, amplifiers, radios and electronic control circuits. Mr. Young

IA 314 Recreational Arts and Crafts 2 (1-2) f s

Required of juniors in Recreation and Park Administration; elective for others.

A course designed to give students interested in recreation work an understanding of different types of art and craft work. Emphasis will be given a wide variety of crafts adaptable to camps, city, industrial and institutional programs. Mr. Finch

IA 315 General Ceramics 3 (1-4) s

This course is designed to give the student an opportunity to work with ceramic materials as a medium of expression and to get experience in the basic manufacturing processes of the ceramic industry. Emphasis will be given to a study of the sources of clay, designing, forming, decorating and firing of ceramic products. Mr. Hostetler

IA 321 Metalwork Technology 2 (1-2) f s

Prerequisite: IA 210

An overview of selected industrial processes and new developments in materials and process application. Emphasis is given to fundamental principles of industrial practices concerned with manufacturing. A research problem involving individual investigation in a specific process and materials area is required. Mr. Moeller

IA 412 Electrical Practicum (Offered 1964-65 only) 3 (1-4) s

Prerequisite: IA 312 or equivalent

A study of design, layout, and construction of basic apparatus in the fields of electricity and electronics. Special emphasis upon the use of the tools and hardware used in the electrical trades. Mr. Young

ED 422 Methods of Teaching Industrial Subjects 3 or 4 (3-2) s

Prerequisites: ED 344, PSY 304

A study of effective methods and techniques of teaching industrial subjects. Emphasis is given to class organization; student-teacher planning; methods of teaching manipulative skills and related information; lesson planning; shop safety; and evaluation. Teaching problems will be studied and analyzed following directed observation in the public schools.

Mr. Hostetler

ED 444 Student Teaching in Industrial Subjects 6 (2-15) f

Prerequisite: ED 422

Students in the Industrial Arts and Industrial Education curricula will devote ten weeks during the fall semester to full, off-campus student teaching in selected public schools throughout the State. They will be assigned to their teaching center in the preceding spring and will report to their supervising teachers when the public schools (to which they are assigned) open in the fall. During the remainder of the term, additional courses will be taken in concentrated form. Staff

IA 465 Independent Study in Industrial Arts 6 credits

Prerequisite: Senior standing

A course designed to develop problem-solving ability through research activities in industrial arts. Problems in industrial arts curriculum, method and content are carefully selected, designs or plans of action are prepared, and final papers are presented and defended before a faculty committee. Staff

IA 480 Modern Industries 3 (3-0) f s

Prerequisite: Senior standing

An overview of the function and organization of modern industry. Principles of work simplification, motion economy, processing, and scheduling are reviewed. The effects of technological change on labor, management, and consumer are considered. Attention will be focused on contributions of technology to specific industrial processes in machining, forming, fabricating in relationship to principles, types of equipment and usage areas. Mr. Young

ED 482 Curriculum Problems in Industrial Arts 2 (1-2) f

Prerequisites: PSY 304 or six credits in Education

This course is devoted to planning and organizing learning units in industrial arts.

ED 483 Instructional Aids and Devices 2 (1-2) f

Prerequisites: PSY 304 or six credits in Education

Analysis of learning units and the preparation of instructional aids and devices. Staff

IA 484 School Shop Planning and Equipment Selection 3 (3-0) f

A course for advanced undergraduate students.

The physical planning of school shops and laboratories; selection of tools and equipment. Whenever possible, actual contemplated school buildings will be used for class work. Mr. Hostetler

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

IA 510 Design for Industrial Arts Teachers 3 (1-4) summer

Prerequisites: Six hours of drawing and IA 205 or equivalent

A study of new developments in the field of design with emphasis on the relationship of material and form in the selection and designing of industrial arts projects. Graduate Staff

ED 552 Industrial Arts in the Elementary School 3 summer

Prerequisites: Twelve credits in Education and consent of instructor

This course is organized to help elementary teachers and principles understand how tools and materials and industrial processes may be used to vitalize and supplement the elementary school children's experience. Practical children's projects along with the building of classroom equipment. Staff

IA 560 (ED 560) New Developments in Industrial Arts Education 3 (3-0) f or s

Prerequisites: Twelve hours in Education and teaching experience

This course is a study of the new developments in industrial arts education. It is designed to assist teachers and administrators in developing new concepts and new content based on the changes in technology. They will be required to re-evaluate their programs in the light of these new concepts and the new content. Mr. Hostetler

IA 590 Laboratory Problems in Industrial Arts maximum 6

Prerequisites: Senior standing, permission of instructor

Courses based on individual problems and designed to give advanced majors in industrial arts education the opportunity to broaden or intensify their knowledge and abilities through investigation and research in the various fields of industrial arts, such as metals, plastics, or ceramics.
Graduate Staff

IA 592 Special Problems in Industrial Arts maximum 6

Prerequisite: One term of student teaching or equivalent

The purpose of these courses is to broaden the subject matter experiences in the areas of industrial arts. Problems involving experimentation, investigation and research in one or more industrial arts areas will be required.
Graduate Staff

IA 595 (ED 595) Industrial Arts Workshop 3 (3-0) summer

Prerequisite: One or more years of teaching experience

A course for experienced teachers, administrators, and supervisors of industrial arts. The primary purpose will be to develop sound principles and practices for initiating, conducting and evaluating programs in this field. Enrollees will pool their knowledge and practical experiences and will do intensive research work on individual and group programs.
Graduate Staff

COURSES FOR GRADUATES ONLY

ED 630 Philosophy of Industrial Arts 2 (2-0) f s

Prerequisite: Twelve hours in Education

Required of all graduate students in industrial arts education. Current and historical developments in industrial arts; philosophy concepts, function, scope, criteria for the selection and evaluation of learning experiences, laboratory organization, student personnel programs, community relationships, teacher qualifications, and problems confronting the industrial arts profession. Mr. Hostetler

ED 635 Administration and Supervision of Industrial Arts 2 (2-0) f s

Prerequisite: Twelve hours in Education

A study of the problems and techniques of administration and supervision in the improvement of industrial arts in the public schools. Selection of teachers and their improvements in service and methods of evaluating industrial arts programs. Mr. Hostetler

ED 692 Seminar in Industrial Arts Education 1 (1-0) f s

Reviews and reports on special topics of interest to students in industrial arts education. Mr. Hostetler

ED 699 Research maximum 6

Prerequisites: Fifteen credits and permission of advisor

Individual research on a specific problem of concern to the student.
Mr. Hostetler

INDUSTRIAL EDUCATION

COURSES FOR UNDERGRADUATES

ED 100 Introduction to Industrial Education 2 (2-0) f

The place of vocational education in a program of public education and the fundamental principles upon which this work is based. Mr. Oleson

ED 305 Analysis of Technical Education Programs and Course Construction 3 (3-0) s

Prerequisites: ED 100 and advanced undergraduate standing

Principles and techniques of selecting and analyzing suitable teaching activities and arranging such material into a functional instructional order. Instructional units prepared will be based on an analysis of a technical occupation or activity. A detailed course of study will be prepared.

Mr. Oleson

ED 327 History and Philosophy of Industrial Technical Education 3 (3-0) f

Prerequisite: ED 100

Historical study of trade and technical education movement. Place function and changing concepts of industrial and technical education in American education. Economic, sociological and psychological aspects.

Mr. Hanson

ED 405 Industrial and Technical Education Shop and Laboratory Planning 3 (3-0) f

Prerequisites: Senior standing and 6 hours of drawing or design

Principles and techniques to assist teachers in planning and organizing shop and laboratory facilities. Problems of locating and equipping vocational schools; the planning and layout of shops and related technology laboratories and classrooms. Individual and group assignments on planning and layout of post secondary schools buildings. Mr. Oleson

ED 422 Methods of Teaching Industrial Subjects 3 or 4 (3-2) s

Prerequisites: ED 344, PSY 304

A study of effective methods and techniques of teaching industrial subjects. Emphasis is given to class organization; student-teacher planning; methods of teaching manipulative skills and related information; lesson planning; shop safety; and evaluation. Teaching problems will be studied and analyzed following directed observations in the public schools.

Staff

ED 440 Vocational Education 2 (2-0) f

Prerequisites: ED 344, PSY 304

A comprehensive study of the types of vocational education of less than college grade, provided for through federal legislation; an evaluation of the effectiveness of the program; and a detailed study of the North Carolina Plan. Staff

ED 444 Student Teaching in Industrial Subjects 6 (2-15) f

Prerequisite: ED 422

Students in the Industrial Arts and Industrial Education curricula will devote ten weeks during the fall semester to full time, off-campus student teaching in selected public schools throughout the State. They wil be assigned to their teaching center in the preceding spring and will report to their supervising teachers when the public schools (to which they are assigned) open in the fall. During the remainder of the term, additional courses will be taken in concentrated form. Staff

ED 483 Instructional Aids and Devices 2 (1-2) f

Prerequisite: PSY 304 or six credits in Education

Analysis of learning units and the preparation of instructional aids and devices. Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 516 Community Occupational Surveys 2 (2-0) s

Prerequisites: Six credits in Education and consent of instructor

Methods in organizing and conducting local surveys and evaluation of findings in planning a program of vocational education. Graduate Staff

ED 521 Organization of Related Study Materials 3 (3-0) f s

Prerequisite: ED 422

The principles of selecting and organizing both technical and general related instructional material for trade extension and industrial cooperative training classes. Graduate Staff

ED 525 Trade Analysis and Course Construction 3 (3-0) f

Prerequisites: ED 344, PSY 304

Principles and practices in analyzing occupations for the purpose of determining teaching content. Practice in the principles underlying industrial course organization based on occupational analysis covering instruction in skills and technology and including course outlines, job sequences, the development of industrial materials and instructional schedules. Graduate Staff

ED 527 Philosophy of Industrial and Technical Education 3 (3-0) f s

Prerequisites: ED 422, ED 440

A presentation of the historical development of industrial and technical education; the types of programs, philosophy, trends and problems of vocational-industrial education; study of federal and state legislation pertaining to industrial education, practical nurse education and technical education. Mr. Nerden

ED 528 Principles and Practices in Industrial Cooperative Training 3 (3-0) f s

Prerequisites: ED 422, ED 440

A study of the developments, the objectives, and principles of industrial cooperative training. The organization, promotion and management of programs in this area of vocational education. Graduate Staff

ED 529 Curriculum Materials Development 3 (3-0) s

Prerequisite: ED 525

Selection and organization of curricula used in vocational-industrial and technical education; development of curricula and instructional materials. Mr. Hanson

ED 591 Special Problems in Industrial Education maximum 6

Prerequisites: Six hours of graduate credit and permission of department head

Directed study to provide individualized study and analysis in specialized areas of trade, industrial or technical subjects.

COURSES FOR GRADUATES ONLY

ED 609 Planning and Organizing Technical Education Programs 3 (3-0) f

Prerequisites: PSY 304, ED 344, ED 420, ED 440, and ED 516

Principles of planning and organizing technical education programs sponsored by federal vocational acts. Professional course for coordinators and directors, with emphasis on the organization of post high school technical education level. Survey of needs, building plans, equipping and maintenance of buildings, financial structure, and personnel organization and management. Mr. Nerden

ED 610 Administration and Supervision of Vocational Education 3 (3-0) s

Prerequisites: PSY 304, ED 344, ED 420, ED 440 or equivalent

Administrative and supervisory problems of vocational education; practices and policies of federal and state officers; organization and administration of city and consolidated systems. Mr. Nerden

ED 691 Seminar in Industrial Education maximum 2

Prerequisite: Graduate standing or permission of instructor

Reviews and reports on topics of special interest to graduate students in industrial education. The course will be offered from time to time in accordance with the availability of distinguished professors. Mr. Hanson

ED 699 Research maximum 6

Prerequisites: 15 credits and permission of advisor

Individual research on a specific problem of concern to the student. Graduate Staff

INDUSTRIAL ENGINEERING

COURSES FOR UNDERGRADUATES

IE 217 Machine Tools 1 (0-2) f s

Prerequisite: Sophomore standing

One session two hours each week consisting of lecture, demonstrations, and student projects. Dimensional control, press forming, power cutting of metals including turning, milling, shaping and finishing. Selection and use of cutting tools, speeds, and feeds.

IE 218 Metal Forming 1 (0-2) f s

Prerequisite: Sophomore standing

One session two hours each week consisting of lecture, demonstrations, and outside assignments. Survey of metals, pattern making, foundry practice, die and permanent mold casting, forging, gas cutting, gas and arc welding.

IE 224 Woodworking Equipment 2 (2-0) s

A study of production woodworking equipment for cutting, standing, and assembly operations; capabilities and limitations of machines, theory and practice of cutting and sanding wood; design and application of saws and cutterheads.

IE 241 Welding Laboratory 1 (0-3) f s

Prerequisite: IE 218 or permission of instructor

A study of mechanization as applied to oxygen cutting, to the various

types of shielded metal arcs and to gas welding. Jigs, fixtures, and positioners. Selection of welding process. Joint design and welding costs. Welds and stress distribution.

IE 301 Engineering Economy 3 (3-0) f s

Prerequisite: Junior standing

Criteria and techniques of engineering economy for management decisions in relation to economy of design, economy of selection, and economy of operation. Study of effects of depreciation policies and machine replacement considerations. Emphasis on problem solving and development of detailed project economy studies.

IE 310 Industrial Safety 2 (2-0) f s

A course in the causes and prevention of industrial accidents.

IE 311 Engineering Project Analysis 3 (3-0) f

Prerequisite: Junior standing

An introduction to the organizational and production problems of industry with emphasis on the development and use of analytical methods for the evaluation of engineering alternatives.

IE 322 Furniture Design and Construction I 2 (0-6) f

Prerequisite: IE 224, FOR 201

An introduction to furniture drawing and construction. Detailed drawings and bills of material are made by the students from samples and from designers sketches. In construction, emphasis is placed upon satisfactory performance under variable atmospheric moisture, upon adequate strength and rigidity and upon low cost.

IE 326 Furniture Manufacture and Processing 4 (3-3) s

Prerequisite: IE 322, FOR 301

Corequisite: IE 332

A study of the production methods of the furniture industry. Class work includes the production procedures from the yard through the machine, cabinet, finishing, upholstering, and shipping departments. The laboratory period is supplemented by visits to furniture plants. Particular attention is paid to production rates by departments, based on number of men and supervisors, the quality of product produced, and equipment used.

IE 327 Furniture Marketing 2 (2-0) f

Study of basic factors bearing on selection of ideal location, equipment, and organization to serve a specific market with a specific factory. In addition to lectures, each student will select one project for which he will work out a solution for correlating product and market.

IE 328 Manufacturing Processes 3 (2-3) s

The basic processes of conversion of raw materials into producer and consumer goods. The cost reduction aspects of machine tools, jigs, and fixtures in volume productions. Study of industrial trends to meet needs of an expanding economy. Selected problems illustrating a wide variety of manufacturing situations.

IE 332 Motion and Time Study 4 (3-3) f s

Principles and techniques of motion and time study, detailed study of charting operator movements; micromotion study. Predetermined time data and its applications; stopwatch time study with emphasis on rating, allowances and standard data theory and practice.

IE 341 Furniture Plant Layout and Design 3 (2-3) f

Prerequisite: IE 326

Problems in industrial plant design with special reference to furniture manufacture; building structures, equipment location, space utilization,

layout for operation and control; allied topics in power utilization, light, heat, ventilation, and safety. Laboratory period.

IE 343 Plant Layout and Materials Handling 3 (2-3) s

Prerequisites: IE 328, IE 332

Problems in plant arrangement and layout to obtain most effective utilization of men, materials, and machines as related to space and costs. Includes consideration of heat, light, ventilation, organization, control, material flow and handling, working conditions, safety, and other factors as they affect the most satisfactory layout of the plant.

IE 345 Principles of Upholstering 2 (2-0) s

Prerequisite: IE 322

Properties of seating equipment; evaluation of these properties. Introduction in the technology of flexible foam materials; slab foam; molded foam; stress strain diagrams; compression set; evaluation tests. Properties of coil springs. Properties of fibrous filling materials. Upholstering constructions. Testing of upholstered furniture. Manufacturing procedures. Cost aspects.

IE 346 Furniture Design and Construction II 2 (2-0) s

Prerequisite: IE 322

Lecture and laboratory work on the design and construction of modern and period furniture. The course emphasizes construction features that are economical of labor and materials and are adaptable to mass production. The course covers the use of new engineering materials and their effect on furniture construction.

IE 350 Mechanisms and Machine Design 3 (2-3) s

Prerequisites: IE 351, EM 301

Fundamental principles of stress, strain, deflection of beams, combined stresses and strains, shafts, spring, gears, linkages, and cams, with emphasis on applications to jig and fixtures design and special tooling.

IE 351 Product and Process Engineering 3 (2-3) f

A study of the selection of materials and processes required in the manufacture of component parts and assembled products. Included will be the study of the interrelationship of product design, materials selected and processes employed in manufacturing operations. Project work will include application of basic principles in typical manufacturing processes. Capabilities and limitations of typical manufacturing equipment and processes will be stressed.

IE 352 Work Analysis and Design 4 (3-3) s

Prerequisite: IE 351

A study of the production processes and work methods for the purpose of improving manpower utilization, reducing human effort, and reducing the costs of production. This includes techniques successfully applied in industry such as operations sequencing, operations analysis, man-machine combinations, motion economy, predetermined motion standards, time study, elemental standard data, production line balancing, manufacturing progress function, lot evaluation, wage incentives and administrative functions.

IE 353 Statistical Quality Control 3 (3-0) s

Prerequisite: A course in Mathematical Statistics

An introduction to statistical techniques applied to industrial problems, including control of industrial systems, and decision making under uncertainty. Included will be a thorough discussion of control chart techniques applied to control of industrial processes as well as an introduction to the extension of these techniques to the control of other industrial systems.

IE 401 Industrial Engineering Analysis I 3 (3-0) f

Prerequisites: MA 405, IE 353

A study of linear programming methods and their applications in industrial engineering; the transportation method with applications to scheduling in transportation and production problems; the simplex method and its applications in production planning, production scheduling and allied fields; upper bound, integer, parametric and primal-dual methods with their typical applications; the interrelationships between linear programming and game theory.

IE 402 Industrial Engineering Analysis II 3 (3-0) s

Prerequisite: IE 401

An introductory study of several aspects of operations research methods with emphasis on their industrial engineering applications; replacement theory, sequencing problems, inventory control methods and dynamic programming and their applications.

IE 403 Industrial Engineering Analysis III 3 (3-0) s

Prerequisite: IE 401

An introductory study of several aspects of operations research methods with emphasis on their industrial engineering applications; continuous and discrete cyberetics with emphasis on Markov processes; finite and infinite queuing models; industrial control methods and industrial dynamics.

IE 404 Introduction to Tool Engineering 3 (2-3) s

Prerequisite: IE 350

The development of effective production process design through a study of theory and characteristics of material removal and forming processes; emphasis on quality requirements of the product, operations study, and the economics of tooling.

IE 408 Production Control 3 (2-3) f

Prerequisite: Senior standing

Planning, scheduling, and dispatching of production in manufacturing operations; conversion of sales requirements into production orders; construction of production budgets and their relation to labor, materials and machines; laboratory project involving the development and operation control system of a typical plant.

IE 420 Manufacturing Controls 3 (3-0) f s

Prerequisite: IE 301

Theory and methodology for developing and maintaining profitable manufacturing operations. Development of principles and procedures for control of materials, manpower, and costs. Special attention to production and inventory control, equipment utilization, wage classification and cost reduction programs.

IE 421 Data Processing and Production Control Systems 3 (3-0) f

Prerequisites: MA 335, IE 352

This course is an introduction to the design of integrated control systems necessary for effective management of production. It will include the methods of systems design, the basic concepts of computer processing systems, the design of control procedures and reports, and their application to mechanized and electronic data processing equipment. Major emphasis will be placed on the design of control procedures for production scheduling, labor performance, quality control. Systems flow charts, block diagrams, and program statements in compiler form will be used for each system application.

IE 430 Job Evaluation and Wage Administration 3 (2-3) s

Prerequisite: Senior standing

Job analysis, classification and specification. Grading, ranking, factor comparison and point systems of job evaluation in determining equitable rates for job content. Wage surveys and merit rating. Utilization of time standards in design, installation, and operation of financial incentive plans. Comparison of various wage and salary plans. Effect of wage payment methods on industrial relations practices.

IE 443 Quality Control 3 (2-2) f s

Prerequisite: ST 361

Economic balance between cost of quality and value of quality, and techniques for accomplishing this balance. Organization for, specification and utilization of quality controls. Statistical theory and analyses as applied to sampling, control charts, tolerance determination, acceptance procedures and control of production.

IE 453 Operations Planning and Plant Layout 3 (2-3) f

Prerequisite: IE 352

This course will provide an opportunity for the student to apply the basic principles contained in the prerequisite courses to the design of plantwide production programs with emphasis placed on planning, arrangement, layout, and implementation of such programs. It will include operations sequencing, tooling, and equipment selection, materials handling, systems design, manpower and facilities forecasting. Suitable cases will be drawn from both mass production and jobbing operations.

IE 491, 492 Seminar 1 (1-0) f s

A weekly meeting of senior students to assist the transition from a college environment to that of industry. Lectures, problems, presentation of papers, and outside speakers. Employment practices and procedures useful in job finding.

IE 495 Project Work 2-6 f s

Prerequisite: Senior standing

Special investigations and research related to furniture construction and processing, and other assigned problems.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

IE 505 (MA 505) Mathematical Programming I 3 (3-0) f

Prerequisite: MA 405

A study of mathematical methods applied to problems of planning. Linear programming will be covered in detail. This course is intended for those who desire to study this subject in depth and detail. It provides a rigorous and complete development of the theoretical and computational aspects of this technique as well as a discussion of a number of applications.

IE 515 Process Engineering 3 (3-0) f

Prerequisites: IE 401, IE 443

The technical process of translating product design into a manufacturing program. The application of industrial engineering in the layout, tooling, methods, standards, costs, and control functions of manufacturing. Laboratory problems covering producer and consumer products.

IE 517 Automatic Processes 3 (3-0) f

Prerequisites: IE 401, IE 443

Principles and methods for automatic processing. The design of product, process, and controls. Economic, physical and sociological effects of automation.

IE 521 Control Systems and Data Processing 3 (3-0) f

Prerequisite: IE 401

This course is designed to train the student in the problems and techniques required for systematic control of the production process and the business enterprise. This includes training in the determination of control factors, the collection and recording of data, and the processing, evaluation, and use of data. The course will illustrate the applications and use of data processing equipment and information machines in industrial processes. Case problems will be used extensively.

IE 522 Dynamics of Industrial Systems 3 credits f

Prerequisite: IE 401

A study of the dynamic properties of industrial systems; introduction to servomechanism theory as applied to company operations. Simulation of large nonlinear, multi-loop, stochastic systems on a digital computer; methods of determining modifications in systems design and/or operating parameters for improved system behavior.

IE 543 Standard Data 3 (3-0) s

Prerequisites: ST 361 or ST 515, one course in Motion and Time Study

Theory and practice in developing standard data from stopwatch observations and predetermined time data; methods of calculating standards from data; application of standard data in cost control, production planning and scheduling, and wage incentives.

IE 546 Advanced Quality Control 3 (3-0) s

Prerequisite: IE 353 or ST 362

The statistical foundations of quality control are emphasized in this course as well as its economic implications. Mathematical derivations of most of the formulas used are given. Sampling techniques are treated extensively and many applications of this powerful technique are explained.

IE 547 Engineering Reliability 3 (3-0) f

Prerequisites: ST 421, IE 304 or IE 353

The methodology of reliability including application of discrete and continuous distribution models and statistical designs; reliability estimation, reliability structure models, reliability demonstration and decisions, and reliability growth models. Examples of reliability evaluation and demonstration programs.

IE 551 Standard Costs for Manufacturing 3 (3-0) s

Prerequisites: One course in Accounting, one course in Motion and Time Study

The development, application and use of standard costs as a management tool; use of industrial engineering techniques in establishing standard costs for labor, material, and overhead. Analysis of variances and setting of budgets. Measures of management performance.

IE 591 Project Work 2 to 6 f s

Prerequisite: Graduate or senior standing

Investigation and report on an assigned problem for students enrolled in the fifth-year curriculum in Industrial Engineering.

COURSES FOR GRADUATES ONLY

IE 607 Selected Topics in Mathematical Programming 3 (3-0) s

Prerequisite: IE 505

This course is a continuation of IE 505 (MA 505). Special techniques like the decomposition principles, network problems, diophantine programming as well as its applications to industrial problems are studied.

An introduction to dynamic programming will also be covered. Multistage decision problems will be worked using linear and dynamic programming. The theoretical foundations of these techniques will be covered but emphasis will be in the applications to planning problems.

IE 621 Inventory Control Methods 3 (3-0) f s

Prerequisites: IE 402, IE 521, ST 421 or MA 421

A study of inventory policy with respect to reorder sizes, minimum points, and production schedules. Simple inventory models with restrictions, price breaks, price changes, analysis of slow-moving inventories. Introduction to the smoothing problem in continuous manufacturing. Applications of linear and dynamic programming and zero-sum game theory.

IE 651 Special Studies in Industrial Engineering credits by arrangement

Prerequisite: Graduate standing

The purpose of this course is to allow individual students or small groups of students to take on studies of special areas in Industrial Engineering which fit into their particular program and which may not be covered by existing industrial engineering graduate level courses. The work would be directed by a qualified staff member who has particular interest in the area covered by the problem. Such problems may require individual research and initiative in the application of industrial engineering training to new areas or fields.

IE 695 Seminar 1 (1-0)

Seminar discussion of industrial engineering problems for graduate students. Case analyses and reports.

IE 699 Industrial Engineering Research credits by arrangement

Graduate research in Industrial Engineering for thesis credit.

INTERNATIONAL STUDENT ORIENTATION

ISO 100 Introduction to the United States 1 credit f

Required of all international students.

LANDSCAPE ARCHITECTURE

COURSES FOR UNDERGRADUATES

LAR 201 Landscape Design I 4 (3-6) f s

Prerequisite: DN 102

Introductory exercises in landscape design. Site development and organization as related to climate, topography, and prevalent social criteria.

Messrs. Phillips, Thurlow

LAR 301, 302 Landscape Design II, III 5 (2-9) f s

Prerequisites: ARC 201, LAR 201

The survey, investigation and analysis of the site. Expansion of first and second year design principles. Solution of small three-dimensional spatial complexes.

Mr. Clarke

LAR 311 Landscape Technology I 4 (3-3) f

Prerequisites: MA 111 or MA 112; ARC 201; LAR 201

Beginning course in the technical aspects of site development. Grading, earthwork quantity computation. Surface runoff and drainage systems. Vehicular circulation principles and techniques. Landscape materials.

Messrs. Clark, Phillips, Thurlow

LAR 312 Landscape Technology II 4 (3-3) s

Prerequisite: LAR 311

Continuation of LAR 311. Site surveying principles. Advanced grading and earthwork. Horizontal and vertical alignment of roads. Road construction. Sanitary sewer system layout. Landscape materials. Correlation with LAR 302.

Mr. Phillips

LAR 401, 402 Landscape Design I, II 6 (3-9) f s

Prerequisite: LAR 302

Ecological and geographic determinants in site planning and design. Emphasis on the design of predominantly non-structural landscape. Correlation with LAR 421, 422.

Mr. Moore

LAR 421, 422 Landscape Technology III, IV 4 (3-3) f s

Prerequisite: LAR 312

The appraisal of plants as objects and their arrangement in the landscape. Soil mechanics, structures, and fertility. Irrigation, drainage structures and exterior illuminations. Construction graphics. Correlation with LAR 401, 402.

Messrs. Clarke, Phillips

LAR 501, 502 Urban and Regional Design I, II 8 (4-12) f s

Prerequisite: LAR 402

Regional research and analysis. Social criteria of Urban and Regional Design. Transportation systems, land use determination and the design of large scale environmental complexes.

Mr. Moore

LAR 511 Advanced Landscape Technology I 4 (3-3) f

Prerequisite: LAR 422

The design and construction of landscape elements. Structures, materials and working drawings. Cost estimation.

Mr. Clarke

LAR 512 Advanced Landscape Technology II 3 (2-1) s

Prerequisite: LAR 511

Contracts, specifications and bidding. Office practice and procedure. Ethics and law.

Mr. Thurlow

MATHEMATICS

MA 111 Algebra and Trigonometry 4 (3-2) f s

Algebraic properties of real numbers; algebra of sets, mappings, functions and graphs. Properties of the complex number field. Applications to systems of equations both linear and quadratic. Other topics in algebra including inequalities, variation, binominal theorem, progressions, theory of equations and determinants. Trigonometric functions of a general angle, identities and multiple angle relations, inverse trigonometric functions, graphs, solution of triangles by logarithms and slide rule with emphasis on the laws of sines and cosines. (Students in the School of Engineering, School of PSAM and Departments of Architecture, Product Design, Agri-

cultural Engineering, and Mathematics Education who may be required to take this couse will not receive credit hours for MA 111 toward the graduation requirements.)

MA 102 Analytic Geometry and Calculus I 4 (3-2) f s
Prerequisite: MA 111 or equivalent completed in high school

Required of freshman in the Schools of Engineering and Physical Sciences and Applied Mathematics. The first of three semesters of a unified course in analytic geometry and calculus. Topics include rectangular coordinates in the plane, graphs and equations of lines, algebraic curves, including the conic sections and others examined by general discussion methods. Also introduced are functions, limits, continuity, differentiation of algebraic functions, with applications of derivatives and differentials.

MA 112 Analytic Geometry and Calculus A 4 (3-2) f s
Prerequisite: MA 111 or equivalent completed in high school

A unified course, beginning with elementary ideas in analytic geometry and calculus; rectangular and polar coordinate systems, fundamental locus problems, lines and conic sections, curve tracing, the derivative, with application to geometry and elementary practical problems.

MA 115 Introduction to Contemporary Mathematics I 3 (3-0) f

Introduction to sets and logic; mathematical induction; evolution of the number system, elementary Boolean algebra; elementary theory of determinants and matrices; progressions; elementary number theory.

MA 116 Introduction to Contemporary Mathematics II 3 (3-0) s
Prerequisite: MA 115

Permutations and combinations; elementary probability; graphs; averages; elementary curve fitting; straight-line calculus; four-color problem and other historical problems in mathematics.

MA 122 Mathematics of Finance and Elementary Statistics 4 (3-2) f s
Prerequisite: MA 111

Simple and compound interest, annuities and their application to amortization and sinking fund problems, installment buying, calculation of premiums of life annuities and life insurance, elementary statistics.

MA 201 Analytic Geometry and Calculus II 4 (3-2) f s
Prerequisite: MA 102 (With a minimum grade of C for students in many curricula)

Required of sophomores in the Schools of Engineering and Physical Sciences and Applied Mathematics. The second of three semesters of a unified course in analytic geometry and calculus. Topics include indefinite and definite integrals of algebraic functions and their applications; differentiation of transcendental functions; polar coordinates, parametric equations, curvilinear motion and curvature; formal integration; integration by parts, substitution, and partial fractions.

MA 202 Analytic Geometry and Calculus III 4 (3-2) f s
Prerequisite: MA 201

Required of sophomores in the Schools of Engineering and Physical Sciences and Applied Mathematics. The third of three semsters of a unified course in analytic geometry and calculus. Topics include areas, volumes, lengths of curves, centroids, moments of inertia of rectangular and polar coordinates; approximate integration, improper integrals, indeterminate

forms; infinite series and expansion of functions; solid analytic geometry and partial differentiation, mutiple integrals in rectangular, cylindrical and spherical coordinates.

MA 211, 212 Analytic Geometry and Calculus B, C 3 (2-2) f s

Prerequisite: MA 112

An integrated course in the fundamentals of calculus, including formal differentiation and integration. Basic application to geometry, rates, maxima and minima, areas, volumes, first and second moments and centroids are included. Additional topics from analytic geometry, not covered in MA 112, are introduced as needed as a basis for calculus.

MA 215 Introduction to Finite Mathematics 3 (3-0) f s

This course includes the following related topics: elementary symbolic logic and truth tables, introduction to sets and subsets, other number systems, the partitioning of sets, introduction to probability theory and finite Stochastic processes, elementary linear programming and game theory.

MA 251 Programming Laboratory I 1 (0-3) f

Corequisite: MA 201

The FORTRAN compiler language; flow charts. Systems of linear equations. Computations with complex numbers. Zeros of simple functions.

MA 252 Programming Laboratory II 1 (0-3) s

Prerequisite: MA 251 or consent of instructor

Corequisite: MA 202

Programming for digital computers; finite differences; approximating functions; numerical integration of ordinary differential equations; errors and error growth.

MA 301 Differential Equations I 3 (3-0) f s

Prerequisite: MA 202

First order equations with variables separable; Euler's method of approximate solution; physical and geometrical applications. Linear equations of first order; applications. Linear equations of higher order with constant coefficients, solution by repeated linear first order equations, variation of parameters, undetermined coefficients, operators. Systems of equations; scaling variables, applications to network and dynamical systems. Introduction to series-solutions; solutions by use of analog computer.

MA 302 Theory of Equations 3 (3-0) f

Prerequisite: MA 202

Algebraic equations; isolation of roots, numerical approximations to roots, the Graeffe method; application of approximation procedures to transcendental equations; systems of linear equations, determinants and introduction to matrix theory.

MA 303 Differential Equations and Infinite Series 4 (4-0) s

Prerequisite: MA 202 (Superior Student Program)

Infinite series and Taylor expansions. First order equations with variables separable; Euler's method of approximate solution; physical and geometrical applications. Linear equations of first order; applications. Linear equations of higher order with constant coefficient, solution by repeated linear first order equations, variation of parameters, undetermined coefficients, operators. Systems of equations; scaling variables, application to networks and dynamical systems. Introduction to series-solutions; solutions by use of analog computer; non-linear differential equations; dimensional analysis. (Students are to take either MA 301 or MA 303, but not both.)

MA 335 Programming for Digital Computers 1 (0-3) f s

Prerequisites: MA 201 or MA 211 and junior standing

Programming for digital computers. Construction and use of flow charts, use of a compiler, and assembly program and machine language instructions.

MA 337 Programming for Computers 3 (1-6) f

Prerequisite: MA 251 or consent of instructor

ALGOL and its syntactic description; symbolic coding language; input/output control systems; monitor or processor operating systems.

MA 351 Computation Laboratory I 1 (0-3) f

Prerequisite: MA 252 or consent of instructor

Corequisite: MA 405

Programming for digital computers involving addition, multiplication, transformation, and inversion of matrices; systems of linear equations; eigenvalues and eigenvectors.

MA 352 Computation Laboratory II 1 (0-3) s

Prerequisites: MA 337, MA 351 or consent of instructor

Corequisite: ST 371 or equivalent

Programming for digital computers involving problems in statistics.

MA 381 Special Topics 1 to 6

Prerequisite: Consent of department

This course will be used to develop unusual or new mathematics courses for the needs of students in any curriculum.

COURSES FOR ADVANCED UNDERGRADUATES

MA 401 Topics from Advanced Calculus I 3 (3-0) f s

Prerequisite: MA 301

Infinite series and integrals, theory of linear dependence of solutions of linear differential equations, variation of parameters, simultaneous linear differential equations by transform methods, series solutions, Bessel, Legendre, Gamma and Beta functions.

MA 402 Topics from Advanced Calculus II 3 (3-0) f s

Prerequisite: MA 401

Partial differentiation, functional dependence, Jacobians, maxima and minima, differentiation of definite integrals involving a parameter, vector analysis, orthogonal functions including Fourier series and Fourier integral, Fourier-Bessel series, and Fourier-Legendre series.

MA 403 Fundamental Concepts of Algebra 3 (3-0) f s

Prerequisite: MA 202 or MA 212

Integers; integral domains; rational numbers; fields, rings, groups. Boolean algebra.

MA 404 Fundamental Concepts of Geometry 3 (3-0) s

Prerequisite: MA 202 or MA 212

Foundations of geometry; laws of logic; affine geometry; geometric transformations; homogeneous coordinates; comparison of Euclidean and non-Euclidean geometrics.

MA 405 Introduction to Determinants and Matrices 3 (3-0) f s

Prerequisite: MA 202 or MA 212

Properties of determinants, theorems of Laplace and Jacobi, systems of linear equations. Elementary operations with matrices inverse, rank, characteristic roots and eigenvectors. Introduction to algebraic forms.

MA 408 Advanced Geometry 3 (3-0) s

Prerequisite: MA 202 or MA 212

Topics from modern geometry; poles and polars; non-Euclidean geometry; analytical geometry from a vector point of view; elementary geometry from an advanced standpoint.

MA 421 Introduction to Probability 3 (3-0) f s

Prerequisite: MA 301 or consent of department

Definitions, discrete and continuous sample spaces, combinatorial analysis, Stirling's formula, simple occupancy and ordering problems, conditional probability, repeated trials, compound experiments, Bayes' theorem, binomial, Poisson and normal distribution, the probability integral, random variables, expectation.

MA 433 History of Mathematics 3 (3-0) s

Prerequisite: MA 202 or MA 212

Evolution of the number system; trends in the development of modern mathematics; lives and contributions of outstanding mathematicians.

MA 451 Numerical Analysis Laboratory I 1 (0-3) f

Prerequisites: MA 337, MA 351 or consent of instructor

Corequisite: MA 527

Programming for digital computers involving subroutines and selected topics in numerical analysis.

MA 452 Numerical Analysis Laboratory II 1 (0-3) s

Prerequisite: MA 451 or consent of instructor

Corequisite: MA 528

Programming for digital computers involving selected topics in numerical analysis.

MA 481 Special Topics 1 to 6

Prerequisite: Consent of department

This will be used to develop unusual or new mathematics courses at the 400-level.

MA 491 Reading in Honors Mathematics 2 to 6

Prerequisites: Membership in Honors Program and permission of department chairman

This is a reading course for exceptionally able students at the junior and senior levels. It will follow the English precedent in university education so that the student will read in some area of advanced mathematics, will present a written report of his reading, and will stand an examination on it.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

MA 505 Mathematical Programming I 3 (3-0)

(See IE 505)

MA 511 Advanced Calculus I 3 (3-0) f s

Prerequisites: MA 301 and, preferably, a B-average in all mathematics courses

Vectors, differential calculus of functions of several variables, vector differential calculus. Definite integral.

MA 512 Advanced Calculus II 3 (3-0) f s

Prerequisite: MA 511

Vector integral calculus, infinite series, integral calculus of functions of several variables.

MA 513 Introduction to Complex Variables 3 (3-0) f s

Prerequisite: MA 512 or consent of department

Operations with complex numbers, derivatives, analytic functions, integrals, definitions and properties of elementary functions, multi-valued functions, power series, residue theory and applications, conformal mapping.

MA 514 Methods of Applied Mathematics 3 (3-0) s

Prerequisite: MA 512 or consent of department

Introduction to difference equations, integral equations, and the calculus of variations.

MA 516 Principles of Mathematical Analysis 3 (3-0) f

Prerequisite: MA 512

The real number system, elements of set theory, limits, continuity, differentiation, Reimann-Stieltjes integration, sequences of functions, fundamentals of Lebesque theory, topological and metric spaces.

MA 517 Introduction to Point Set Topology 3 (3-0) s

Prerequisite: MA 516

A study of basic set-theoretic and general topological notions of modern mathematics. Topics include set theory and cardinal numbers, topological spaces, metric spaces, and elementary discussion of function spaces.

MA 524 Boundary Value Problems 3 (3-0) f s

Prerequisite: MA 402 or MA 511

Theory of first variation with applications to various physical phenomena (vibrating string, vibrating membrane, heat conduction, and wave propagation); Bernoulli's separation theorem with application to vibration and heat conduction problems; Fourier series, Fourier-Bessel series, and Fourier-Legendre series and a full discussion of the Sturm-Liouville problem; and numerical approximation of eigenvalues by Rayleigh-Ritz method.

MA 527 Numerical Analysis I 3 (3-0) f s

Prerequisite: MA 402 or MA 511

Numerical solution of equations, introduction to the theory of errors, finite-differences tables and the theory of interpolation, numerical integration, numerical differentiation, and elements of difference calculus.

MA 528 Numerical Analysis II 3 (3-0) s

Prerequisite: MA 527

Difference operators, summation procedures, numerical solution of ordinary differential equations, least-squares polynominal approximation, and Gaussian quadrature.

MA 532 Differential Equations 3 (3-0) f

Prerequisite: MA 511

Phase-plane concepts; elementary critical points and stability theory; second order linear equations with variable coefficients; general linear autonomous systems; forced oscillations of linear systems; the method of Frobenius; Bessel, Legende and hypergeometric functions; regular singular points; Sturm-Liouville systems; eigenvalue problems and generalized Fourier expansions; existence and uniqueness theorems.

MA 536 Logic for Digital Computers 3 (3-0) f

Prerequisite: MA 402 or MA 511

Introduction to logic and formal languages of digital computers, algorithms, compilers, and heuristic programming.

MA 537 Non-numeric Uses of Computers 3 (3-0) s

Prerequisite: MA 536

The use of computers in problems not involving numerical analysis. Formal differentiation and integration, algebraic models, combinatorics, theorem proving and decision making. Problems of mechanical translation. Special computers.

MA 541 (ST 541) Theory of Probability I 3 (3-0) f

Prerequisite: MA 511

Axioms, discrete and continuous sample, events, combinatorial analysis, conditional probability, repeated trials, independence, random variables, expectation, special discrete and continuous distributions, probability and moment generating functions, central limit theorem, laws of large numbers, branching processes, recurrent events, random walk.

MA 542 (ST 542) Theory of Probability II 3 (3-0) s

Prerequisites: MA 405, MA 541

Markov chains and Markov processes, Poisson process, birth and death processes, queueing theory, renewal theory, stationary processes, Brownian motion, information theory.

MA 555 (PY 555) Principles of Astrodynamics 3 (3-0) s

Prerequisites: MA 511, PY 411 or EM 555

The differential equations of motion in two-body problems and their integrals; orbit theory; integrals of the n-body problem; differential equations of motion of natural and artificial satellites and their approximate solutions.

MA 571 (BS 571, ST 571) Biomathematics I 3 (3-0)

(See ST 571.)

MA 572 (BS 572, ST 572) Biomathematics II 3 (3-0)

(See ST 572.)

MA 581 Special Topics 3 credits

Prerequisite: Consent of department

This will be used to develop unusual or new mathematics courses at the 500-level.

COURSES FOR GRADUATES ONLY

MA 602 Partial Differential Equations 3 (3-0) f

Prerequisite: MA 512

Ordinary differential equations in more than two variables, partial dif-

ferential equations of the first order, partial differential equations of the second order, Laplace's equation, the wave equation, the diffusion equation.

MA 605 Non-Linear Differential Equations 3 (3-0) s
Prerequisites: MA 512, MA 532

Phase-plane and phase-space concepts; existence and uniqueness theorems; continuity, analytic and differentiability properties of solution; properties of linear systems; stability in non-linear systems; topological methods; perturbations of periodic solutions; asymptotic methods and resonance problems.
Mr. Struble

MA 606 Mathematical Programming II 3 (3-0)
(See ST 606.)

MA 607 Special Topics in Mathematical Programming 3 (3-0)
(See IE 607.)

MA 608 Integral Equations alternate summers 3 (3-0)
Prerequisites: MA 512, MA 532

Linear Volterra integral equations of the first and second kinds. Relationship to linear differential initial value problems. Special Volterra equations of the convolution type. Singular Volterra equations. Linear Fredholm integral equations of the first and second kind. Basic theory. Symmetric kernels. Hilbert-Schmidt theory (generalizations).
Mr. Winton

MA 611 Complex Variable Theory and Applications I 3 (3-0) f
Prerequisite: MA 512

Elementary functions; analytic functions and Cauchy-Riemann equations; conformal mapping and applications; Taylor and Laurent series; contour integration and residue theory; the Schwarz-Christoffel transformation.
Messrs. Bullock, Sagan

MA 612 Complex Variable Theory and Applications II 3 (3-0) s
Prerequisite: MA 611

Conformal mapping and applications to flow phenomena; multiple-valued functions and Riemann surfaces; further applications of residue theory; analytic continuation; infinite series and asymptotic expansions; elliptic functions and other special functions in the complex domain; structure of functions.
Mr. Bullock

MA 615 Theory of Functions of a Real Variable I 3 (3-0) f
Prerequisite: MA 516, MA 517 or consent of department

Sets and spaces; continuity and differentiability of real functions.
Mr. Harrington

MA 616 Theory of Functions of a Real Variable II 3 (3-0) s
Prerequisite: MA 615

Measure, measurable sets and functions, theory of Lebesque integration.
Mr. Harrington

MA 621 Introduction to Modern Abstract Algebra 3 (3-0) f
Prerequisite: MA 512

A study of the abstract structure and properties of groups, rings and ideals and fields.
Messrs. Nahikian, Park

MA 622 Vector Spaces and Matrices 3 (3-0) s
Prerequisite: MA 405 or consent of department

A study of vector spaces and their relation to the theory of matrices. Matrix inversion, linear transformations, including similarity and ortho-

gonal transformations, canonical forms. Properties of the characteristic and reduced characteristic functions. Elementary divisors and functions of matrices. Applications to systems of differential equations.
Messrs. Nahikian, Park

MA 625 Introduction to Differential Geometry — alternate summers 3 (3-0)

Prerequisite: MA 512

Theory of curves and surfaces in 3-dimensional Euclidean space with special reference to those properties invariant under the rigid body motions.
Messrs. Levine, Winton

MA 632 Operational Mathematics I — 3 (3-0) f

Corequisite: MA 513 or MA 611

Laplace transform with theory and application to problems in ordinary and partial differential equations arising from engineering and physics problems; Fourier integral and Fourier transforms and applications.
Messrs. Cell, Harrington

MA 633 Operational Mathematics II — 3 (3-0) s

Prerequisite: MA 632

Extended development of the Laplace and Fourier transform and their uses in the solution of problems in ordinary and partial differential equations and in difference equations; Strum-Liouville systems; advanced theory in ordinary and partial differential equations; other infinite and finite transforms and their applications. Messrs. Cell, Harrington

MA 635 Mathematics of Computers — 3 (3-0) f

Prerequisites: MA 528, MA 512, MA 335

Corequisite: MA 405 or MA 622

The development of methods for the solution of selected problems involving matrices; integral rational equations; ordinary and partial differential equations. Particular attention is paid to the question of convergence and stability; examples solved on the IBM 650. Mr. Lieberstein

MA 641 Calculus of Variations — alternate summers 3 (3-0)

Prerequisite: MA 512

The simplest problem of the calculus of variations in detail; variable endpoints; isoperimetric problems; Hamilton's principles; least action principle; generalizations. Mr. Winton

MA 651 Expansion of Functions — alternate summers 3 (3-0)

Prerequisites: MA 611, MA 633 or equivalent

Expansion of functions of one or more variables in Taylor series; asymtotic series; infinite products, partial fractions, continued fractions, series of orthogonal functions; applications in ordinary partial differential equations, difference equations and integral equations. Messrs. Cell, Harrington

MA 661 Tensor Analysis I — 3 (3-0) f

Prerequisite: MA 512

The basic theory, tensor algebra, tensor calculus; invariants of quadratic differential forms; covariant differentiation; geometric applications, Reimannian spaces; generalized vector analysis. Mr. Levine

MA 662 Tensor Analysis II — 3 (3-0) s

Prerequisite: MA 661

Continuation of MA 661. Physical applications; dynamics, Legrange's

equations, the geometry of dynamics, cofiguration spaces. Further applications to electromagnetic theory and elasticity.

MA 681 Special Topics in Analysis maximum 6

MA 683 Special Topics in Algebra maximum 6

MA 685 Special Topics in Numerical Analysis maximum 6

MA 687 Special Topics in Geometry maximum 6

MA 689 Special Topics in Applied Mathematics maximum 6

The above courses, MA 681-MA 689, afford opportunities for graduate students to study advanced topics in mathematics under the direction of members of the graduate staff. These will on occasion consist of one of several areas such as, for example, advanced theory of partial differential equations, topology, mathematics of plasticity or of viscoelasticity, mathematics of orbital mechanics.

MA 699 Research in Mathematics credits by arrangement

Prerequisites: Graduate standing, approval of advisor

Individual research in the field of mathematics.

MATHEMATICS AND SCIENCE EDUCATION

COURSES FOR UNDERGRADUATES

ED 203 Introduction to Teaching Mathematics and Science 2 (2-0) s

A course designed to aid prospective teachers in becoming familiar with the scope and purposes of secondary education, the qualification and responsibilities of teachers, the relation of the school to the community, and problems of secondary school teachers. Mr. Speece

ED 470 Methods of Teaching Mathematics 3 (3-0) f

A study of the purposes, methods, materials, curricula and evaluation practices appropriate for teachers of mathematics at the secondary level. Mr. Speece

ED 471 Student Teaching in Mathematics 6 (2-15) f

This course is intended to provide the prospective teacher with an opportunity to get experience in the skills and techniques involved in teaching mathematics. Each student during the senior year will spend 10 weeks off-campus in a selected center. In addition to acquiring the necessary competencies for teaching mathematics, the student teachers will also have an opportunity to become familiar with the total school program and to participate in as many community activities as time will permit during the period of student teaching. Messrs. Anderson, Shannon, Speece

ED 472 Developing and Selecting Teaching Materials in Mathematics 2 (2-0) f

Developing and selecting teaching materials in keeping with the new and changing concepts of the content and emphasis in high school mathematics is essential for mathematics teachers. The course will follow the class discussion and demonstration pattern. Students will study the latest instructional materials and discover or devise materials and aids for increasing the effectiveness of the content and instruction in high school mathematics. Mr. Speece

ED 475 Methods of Teaching Science 3 (3-0) f

A study of the purposes, methods, materials, curricula and evaluation practices appropriate for teachers of physical and natural science at the secondary level. Messrs. Anderson, Shannon

ED 476 Student Teaching in Science 6 (2-15) f

This course is intended to provide the prospective teacher with an opportunity to get experience in the skills and techniques involved in teaching science. Each student during the senior year will spend 10 weeks off-campus in a selected center. In addition to acquiring the necessary competencies for teaching science, the student teacher will also have an opportunity to become familiar with the total program and to participate in as many community activities as time will permit during the period of student teaching. Messrs. Anderson, Shannon, Speece

ED 477 Developing and Selecting Teaching Materials in Science 2 (2-0) f

Developing and selecting teaching materials in keeping with the new and changing concepts of the content and emphasis in high school science, particularly the experimental and laboratory approach to science teaching. Students will study the latest instructional materials and discover or devise materials and aids for increasing the effectiveness of the content and instruction in high school science courses. Messrs. Anderson, Shannon

COURSES FOR GRADUATES

ED 592 Special Problems in Mathematics Teaching 3 (3-0) s

Consideration of current problems in mathematics education. Opportunities will be provided for students to study particular problems and initiate investigations under the direction of the faculty. Mr. Speece

ED 594 Special Problems in Science Teaching 3 (3-0) s

Consideration of current problems in science education. Opportunities will be provided for students to study particular problems and initiate investigations under the direction of the faculty. Staff

ED 690 Seminar in Mathematics Teaching maximum 2

Consideration of issues, trends and recent developments in mathematics education.

ED 695 Seminar in Science Teaching maximum 2

Consideration of issues, trends and recent developments in science education. Staff

ED 699 Research maximum 6

Prerequisites: 15 credits and permission of advisor

Individual research on a specific problem of concern to the student. Graduate Staff

MECHANICAL ENGINEERING

COURSES FOR UNDERGRADUATES

ME 211 Introduction to Mechanical Engineering 3 (3-0) f

Prerequisite: CH 103

Corequisites: MA 202, PY 208

An elementary consideration of some of the scope and interests in mechanical engineering through the application and extension of the basic laws of chemistry and physics.

ME 212 Mechanical Analysis 3 (3-0) s

Prerequisite: ME 211

Corequisite: EM 200

An introduction to a logical method of problem solving through the integration of the fundamentals of physics, mechanics, and mathematics and their utilization in a rigorous training in methods of analysis of real engineering problems.

ME 301 Engineering Thermodynamics I 3 (3-0) f s

Prerequisites: MA 202, PY 208

Probability, uncertainty, information and entropy; the perfect gas; energy levels and quantum states; Maxwell-Boltzmann distribution of energies and speeds; principle of increase of entropy; conservation of energy, thermodynamic properties of systems; applications to the closed and open systems; fundamentals of energy conversion and refrigeration.

ME 302 Engineering Thermodynamics II 3 (3-0) s

Prerequisite: ME 301

A continuation of Engineering Thermodynamics I with the emphasis on the engineering application of the basic principles to problems involving mixtures of perfect gases, psychrometrics, imperfect gases, equations of state, chemical reactions, combustion, law of mass action, dissociation and ionization, and equilibrium composition.

ME 303 Engineering Thermodynamics III 3 (3-0) s

Prerequisite: ME 301

A continuation of Engineering Thermodynamics I for non-Mechanical Engineering juniors. Thermodynamics of mixtures; thermodynamics of fluid flow, heat transfer, vapor and gas cycles and applications.

ME 304 Fundamentals of Heat Power 3 (3-0) f

Prerequisite: PY 211

Energy and energy transformations, including a brief discussion of measurements of quantities involved. Properties of working substances, particularly steam. Elementary combustion of fuels. Steam power cycles and applications to steam turbines. Elements of heat transfer.

ME 305 Mechanical Engineering Laboratory I 1 (0-3) f

Corequisite: ME 301

Theory and principles involved in instrumentation and measurements. Limitation and sources of error of each technique studied. Utilization of the instrumentation in predetermined situations that exhibit the essential characteristics of the instrumentation. Consideration of transient and steady state techniques. Areas of study: pyrometric measurements, piezo measurements and measurements of flow properties.

ME 306 Mechanical Engineering Laboratory II 1 (0-3) s

Prerequisites: ME 305, EM 301

A continuation of ME 305 with emphasis on measurements of kinematic quantities, measurements of thermophysical properties and energy measurements. Treatment of experimental data.

ME 307 Energy and Energy Transformations 3 (3-0) f

Prerequisites: MA 201, PY 212

Required of Juniors in the Engineering Operations Curriculum.

Energy transformation as permitted by the First Law and limited by the Second Law. Properties of ideal gases and actual gases; properties of vapors. Vapor power cycles; vapor refrigerating cycles, gas cycles for internal combustion engines and gas turbines. Elements of heat transfer.

ME 313 Power Transmission 3 (3-0) s

Prerequisite: ME 307

Elective in the Engineering Operations Curriculum.

Fundamentals of the analysis, synthesis and resultant operational characteristics of machines and systems including mechanical, hydraulic and pneumatic power transmission and control devices. Also included will be applications of hydrodynamic and anti-friction bearings, transmission and machine shafting.

Emphasis will be placed upon analysis of operational requirements and study of comparative characteristics of the above-mentioned devices with regard to determination of optimum components and system combinations on the basis of performance, maintenance, economics, etc.

ME 315 Dynamics of Machines 3 (3-0) f

Prerequisite: ME 212

A rational application of dynamics to the analysis of machines and mechanical devices to determine the motions resulting from applied loads and the forces and inputs required to produce specified motions.

ME 352 Aerodynamics 3 (3-0) f

Prerequisites: EM 200, MA 301

Fundamental concepts underlying experimental aerodynamics, the aerodynamicist's data, elementary flow theory, Reynolds number and the effect of viscosity, Mach number and compressibility, finite wing theory.

ME 353 Introduction to Aerothermodynamics 3 (3-0) s

Prerequisites: ME 301, C or better in ME 352

A specialization of thermodynamics to the study of inviscid, compressible flows of perfect gases. The theory is applied to channel flows, shock waves, expansions, and two-dimensional airfoil theory.

ME 369 Aircraft and Missile Structures 3 (3-0) s

Prerequisite: EM 301

To provide the basic structural background necessary to the design of light weight structures for flight in and beyond the atmosphere.

COURSES FOR ADVANCED UNDERGRADUATES

ME 401 Energy Conversion 3 (3-0) f s

Prerequisite: ME 302

A course on the conversion of energy for engineering purposes based upon the fundamentals leading to engineering decisions in the arrangement and selecting of energy conversion equipment. The conventional type of plant for energy conversion and the unconventional types, in particular, direct energy conversion and the feasibility of such plants. Factors which affect the cost of power and elements entering into the problem of monetary rates.

ME 402 Heat and Mass Transfer 3 (3-0) f s

Prerequisites: ME 302, MA 301

A study of the fundamental relationships of steady and transient heat transfer by conduction, convection, radiation and during changes of phase; mass transfer by diffusion and convection; simultaneous mass and heat transfer.

ME 403 Air Conditioning 3 (3-0) f

Prerequisite: ME 302

A fundamental study of summer and winter air conditioning including temperature, humidity, air velocity and distribution.

ME 404 Refrigeration 3 (3-0) s

Prerequsite: ME 302

A thermodynamic analysis of the simple, compound, centrifugal and multiple effect compression systems, the steam jet system and the absorption system of refrigeration.

ME 405 Mechanical Engineering Laboratory III 1 (0-3) f

Prerequisite: ME 306

The selection of appropriate instrumentation and the experimental analysis of small, predetermined engineering systems designed for flexibility and wide variation of parameters. Systems cover the gamut of Mechanical Engineering activity with emphasis on analysis of systems rather than characteristics of particular systems.

ME 406 Mechanical Engineering Laboratory IV 1 (0-3) s

Prerequisite: ME 405

Individual or small group investigation of an original problem under the supervision of a faculty member with an interest in the problem area. The investigation may be experimental, analytical, or both. Emphasis is placed on the philosophy and methodology of engineering research, and on individual thinking and effort.

ME 410 Jet Propulsion 3 (3-0) s

Prerequisites: ME 302, ME 352 or EM 303

Application of fundamental principles of thermodynamics and the mechanics of a compressible fluid to the processes of jet-propulsion and turbopropeller aircraft; the effect of performance of components on performance of engine; analysis of engine performance parameters.

ME 411, 412 Mechanical Design I, II 3 (3-0) f s

Prerequisites: EM 301, MIM 201, ME 315

Application of the basic principles of the mechanical sciences to the analysis and design of machines, devices and mechanical systems. Consideration of the complete design process including formulation of design concepts, synthesis of components, analysis of the assembly, and evaluation of the finalized design. Project activity with design orientation.

ME 421 Aerospace Propulsion Systems 3 (3-0) s

Prerequisite: ME 353

Corequisite: ME 461

A study of propulsion systems and their relation to the various flight regimes and space missions. The principles of thrust generation, the control, and the performance of various propulsion systems will be considered.

ME 431 Thermodynamics of Fluid Flow 3 (3-0) f s

Prerequisites: MA 301, ME 302, EM 303 or ME 352

The fundamental dynamics and thermodynamic principles governing the flow of gases are presented from both theoretical and experimental viewpoints. Mathematical relations are closely correlated with physical phenomena to emphasize the complimentary nature of theory and experiment.

ME 432 Boundary Layer Theory and Heat Transfer 3 (3-0) s

Prerequisites: C or better in ME 352, MA 401 or MA 511

The course is intended to give the student both a physical and mathematical understanding of the problems of skin friction and heat transfer in present-day aerospace engineering.

ME 435 Industrial Automatic Controls 3 (3-0) f s

Prerequisites: ME 301, MA 301

Introduction to concept of automatic controls; fundamentals of two-position, proportional, floating and rate modes of control with a graphical and analytical presentation of each. Theoretical considerations of the process and an introduction to system analysis.

ME 447 Performance, Stability and Control of Flight Vehicles 3 (3-0) f

Prerequisites: C or better in ME 352, MA 401 or MA 511

A study of aerodynamic and inertial factors and how they influence the motion of flight vehicles and their performance. The transfer function approach is emphasized in the analysis of flight vehicle motion.

ME 451 Introduction to Rocketry 3 (3-0) f or s

Prerequisites: ME 301, ME 352 or equivalent

Basic principles of rocket propulsion. Consideration of the significance and use of parameters such as specific impulse, characteristic velocity, thrust coefficient. General description of liquid, solid and hybrid power plants. Performance calculations and design considerations.

ME 453 Applied Aerodynamics 3 (3-0) f

Prerequisite: ME 352

Determination of design data, tunnel wall and ground effect interference corrections, spanwise and chordwise load distributions, performance estimation, and stability and control analysis. Attention is given to transonic and supersonic aerodynamics.

ME 461 Aerospace Technology 3 (3-0) f

Prerequisite: ME 353

An introduction to the principles of flight in and beyond the atmosphere. Includes the elements of aerodynamics of flight, the reentry problem, flight dynamics, guidance and control, power generation in space, manned and unmanned space flight and life support systems.

ME 465, 466 Aerospace Engineering Laboratory 1 (0-3) f s

Prerequisites: ME 306, ME 352

Laboratory experience in wind tunnel experimentation, structural testing, environmental testing, and instrumentation for flight in and beyond the atmosphere.

ME 468 Spacecraft Structures 3 (3-0) f

Prerequisite: ME 369

Corequisite: ME 461

Basic techniques and procedures in the analysis of stresses and strains

caused by the extreme heating of reentry space vehicles as well as the dynamic and impulsive loads occurring during the launching and loading period of flight will be considered and the resulting effects on the vehicle structure will be studied.

ME 481 Flight Vehicle Design 5 (3-6) s

Prerequisites: ME 461, ME 468, ME 447, ME 421, EE 202

Integration of previous aerodynamic, heat transfer, materials, structures, and dynamical theory in the design of typical air supported and space vehicles and their sub-systems.

ME 495 Technical Seminar 1 (1-0) f s

Prerequisite: Graduating senior standing

Meetings once a week for the delivery and discussion of student papers on topics of current interest in Mechanical Engineering.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ME 501 Steam and Gas Turbines 3 (3-0) f s

Prerequisites: ME 302, EM 303 or ME 352

Fundamental analysis of the theory and design of turbomachinery flow passages; control and performance of turbomachinery; gas-turbine engine processes.

ME 507, 508 Internal Combustion Engine Fundamentals 3 (3-0) f s

Prerequisite: ME 302

The fundamentals common to internal combustion engine cycles of operation. The Otto engine: carburetion, fuel distribution, flame propagation, normal and knocking combustion, throttling, pumping, valve and spark timing, and altitude effects; the Diesel engine: injection and spray formation fuel rating, atomization, penetration, diesel knock, combustion, precombustion, and scavenging as applied to reciprocating and rotary engines.

ME 515 Experimental Stress Analysis 3 (2-3) f

Prerequisite: ME 315

Theoretical and experimental techniques of strain and stress analysis, with experimental emphasis on electrical strain gages and instrumentation, brittle coatings, grid methods, and photoelasticity. Laboratory includes a full experimental investigation and report of a problem chosen by the student under the guidance of the instructor.

ME 516 Photoelasticity 3 (2-3) s

Prerequisite: ME 411

Two and three-dimensional photoelasticity; the stress-optic law, isochromatics, isoclinics, stress trajectories, fractional orders of interference; three dimensional techniques, oblique incidence, rotational and thickness effects; determination of principal stresses at interior points; laboratory investigations.

ME 517 Lubrication 3 (2-3) s

Prerequisite: EM 303

The theory of hydrodynamic lubrication; Reynold's equation, the Sommerfield integration, effect of variable lubricant properties and energy equation for temperature rise. Properties of lubricants. Application to design of bearings. Boundary lubrication.

ME 521 Aerothermodynamics 3 (3-0) f or s

Prerequisites: ME 301, ME 352 or EM 303

Review of basic thermodynamics pertinent to gasdynamics. Detailed development of the general equations governing gas motion in both differential and integral form. Simplification of the equations to those for specialized flow regimes. Similarity parameters. Applications to simpler problems in various flow regimes.

ME 541, 542 Aerodynamic Heating 3 (3-0) f s

Prerequisites: MA 511, ME 521 or equivalent

A detailed study of the latest theoretical and experimental findings of the compressible laminar and turbulent boundary layers with special attention to the aerodynamic heating problem; application of theory in the analysis and design of aerospace hardware.

ME 545, 546 Project Work in Mechanical Engineering I, II 2 (0-4) f s

Individual or small group investigation of a problem stemming from a mutual student-faculty interest. Emphasis is placed on providing a situation for exploiting student curiosity.

ME 554 Advanced Aerodynamic Theory 3 (3-0) s

Prerequisite: ME 352

Development of fundamental aerodynamic theory. Emphasis upon mathematical analysis and derivation of equations of motion, airfoil theory and comparison with experimental results. Introduction to supersonic flow theory.

ME 562 Advanced Aircraft Structures 3 (3-0) s

Prerequisite: ME 468

Development of methods of stress analysis for aircraft structures, special problems in structural design, stiffened panels, rigid frames, indeterminate structures, general relaxation theory.

ME 581, 582 Hypersonic Aerodynamics 3 (3-0) f s

Prerequisites: MA 512, ME 521

A detailed study of the latest theoretical and experimental findings in hypersonic aerodynamics.

ME 593 Special Topics in Mechanical Engineering 3 credits f or s

Faculty and student discussions of special topics in Mechanical Engineering.

COURSES FOR GRADUATES ONLY

ME 601 Advanced Engineering Thermodynamics 3 (3-0) f

Prerequisite: ME 302

Thermodynamics of a general reactive system; conservation of energy and the principle of increase of entropy; the fundamental relation of thermodynamics; Legendre transformations; equilibrium and stability criteria in different representations; general relations; chemical thermodynamics; multireaction systems; ionization; irreversible thermodynamics; the Onsager relation; applications to thermoelectric, thermomagnetic and diffusional processes.

ME 602 Statistical Thermodynamics 3 (3-0) s

Prerequisites: ME 601, MA 511

Fundamental principles of kinetic theory, quantum mechanics, statistical mechanics and irreversible phenomena with particular reference to thermo-

dynamics systems and processes. The conclusions of the classical thermodynamics are analyzed and established from the microscopic viewpoint.

ME 603 Advanced Power Plants 3 (3-0) f
Prerequisite: ME 401

A critical analysis of the energy balance of thermal power plants; thermodynamics and economic evaluation of alternate schemes of development; study of recent developments in the production of power.

ME 605 Aerothermochemistry 3 (3-0) s
Prerequisites: ME 601, MA 511

A generalized treatment of combustion thermodynamics including derivation of thermodynamic quantities by the method of Jacobians, criteria for thermodynamic equilibrium, computation of equilibrium composition and adiabatic flame temperature. Introduction to classical chemical kinetics. Conservation equations for a reacting system, detonation and deflagration. Theories of flame propagation, flame stabilization, and turbulent combustion.

ME 606 Advanced Gas Dynamics 3 (3-0) s
Prerequisites: ME 521, ME 601, MA 511

The general conservation equations of gas dynamics from a differential and integral point of view. Hyperbolic compressible flow equations, unsteady one-dimensional flows, the non-linear problem of shock wave formation, isentropic plane flow, flow in nozzles and jets, turbulent flow.

ME 608 Advanced Heat Transfer I 3 (3-0) f
Prerequisite: ME 402

Fundamental aspects, from an advanced viewpoint, will be considered in the conduction of heat through solids, convective phenomena, and the measurement and prediction of appropriate physical properties. Boundary value problems arising in heat conduction will be examined and both numerical and function solution techniques developed. Internal and external boundary layer analyses will be made on a variety of respective convection situations.

ME 609 Advanced Heat Transfer II 3 (3-0) s
Prerequisite: ME 608

Advanced topics in the non-isothermal flow of fluids through channels will be investigated for slug, laminar, transitional and turbulent conditions. The influence of mass transfer on flow and heat transfer processes will be considered. Radiation exchange processes between solid surfaces and solid surfaces and gases both stationary and moving will be discussed.

ME 610 Advanced Topics in Heat Transfer 3 (3-0) f
Prerequisite: ME 609

This course constitutes a study of recent developments in heat transfer and related areas. It is anticipated that the course content will change from semester to semester.

ME 611, 612 Advanced Machine Design I, II 3 (3-0) f s
Prerequisite: ME 412

Kinematics of mechanical media, the stress tensor, the tensor of strains, elasticity, plasticity, time-dependent behavior; theories of failure, working stresses; shock and steady dynamic loading, creep, stress concentration, thermal stress, contact stresses; energy theories, finite difference and relaxation methods; hydrodynamic lubrication. Application to the design of machine frames, shafts, bearings, gears, springs, cams, etc.

ME 613 Mechanics of Machinery 3 (3-0) f

Prerequisites: ME 315, MA 512 or MA 402

Vector dynamics, d'Alembert's principle, Lagrange's equations; rigid kinematics, Euler's angles, rigid rotation, Coriolis accelerations; the inertia tensor. Application to mechanisms, gyroscopes, guidance and control systems, rotating and reciprocating devices.

ME 614 Mechanical Transients and Machine Vibrations 3 (3-0) s

Prerequisites: ME 315 or EM 545, MA 512 or MA 402

Dynamic loads in mechanical media are considered in two categories—steady vibrations and transient shock and impact. The Lagrange equations and the wave equation are employed to study internal stresses and displacements in mechanical devices which result from such loading.

ME 615 Aeroelasticity I 3 (3-0) f

Prerequisites: MA 511, ME 411 or ME 468, ME 521

Deformations of aero structures under static and dynamic loads, natural mode shapes and frequencies; two and three dimensional incompressible flow, wings, and bodies in unsteady flow; static aeroelastic phenomena.

ME 616 Aeroelasticity II 3 (3-0) s

Prerequisite: ME 615

Flutter, dynamic response phenomena such as transient landing stresses, gusts, continuous atmospheric turbulence; aeroelasticity model theory, model design and construction.

ME 617 Plates and Shells in Mechanical Design 3 (3-0) s

Prerequisites: MA 511, ME 611

The concept of members which are thin in one dimension, that is, plates and shells, is applied to mechanical design with particular emphasis on type of loading, conditions of service, and compliance of the member to its environment.

ME 625, 626 Direct Energy Conversion 3 credits f s

Prerequisite: ME 601

An engineering study of the modern developments in the field of conversion of heat to power in order to meet new technology demands. Thermoelectric, thermomagnetic, thermionic, photovoltaic and magnetohydrodynamic effects and their utilization for energy conversion purposes, static and dynamic response, limitations imposed by the first and second laws of thermodynamics. Energy and entropy balances, irreversible sources; inherent losses, cascading, design procedures, experimental studies to determine the response and efficiency of various systems.

ME 631 Applications of Ultrasonics to Engineering Research 3 (3-0) f

Prerequisites: MA 511, EE 332

The technique and theory of propagation of ultrasonics in liquids, gases and solids. Development of ultrasonic transducers, the elastic piezoelectric and dielectric relationships. Ultrasonic applications of asdic or sonar, cavitation, emulsification, soldering, welding, and acoustic properties of gases, liquids and solids.

ME 651 Principles of Fluid Motion 3 (3-0) f

Prerequisites: ME 352 or equivalent; MA 511

Fundamental principles of fluid dynamics. Mathematical methods of analysis are emphasized. Potential flow theory development with introduction to the effects of viscosity and compressibility. Two dimensional and three dimensional phenomena are considered.

ME 652 Dynamics of Compressible Flow 3 (3-0) f

Prerequisites: ME 521, MA 511

Properties of compressible fluids, equation of motion in one-dimensional motion, channel flows, shock wave theory, methods of observation, and flows at transonic speeds.

ME 653 Supersonic Aerodynamics 3 (3-0) s

Prerequisite: ME 652

Equations of motion in supersonic flow, Prandtl-Meyer turns, method of characteristics, hodograph plane, supersonic wind tunnels, supersonic airfoil theory, and boundary layer shock interaction.

ME 654 Dynamics of Viscous Fluids 3 (3-0) s

Prerequisite: ME 521

Development of the Navier-Stokes equation and the boundary layer theory. Laminar and turbulent boundary layers in theory and experiment, flow separation, and transition.

ME 657 Measurements in Rarefied Gas Streams 3(3-0) f

Prerequisite: ME 602

A study of the basis for measurement of flow properties in rarefied gas streams. Included will be ionization gauges, hot wire anemometers and temperature probes, pitot and static tubes, Langmuir probes, electron scattering and electron beam density gauges.

ME 658, 659 Molecular Gasdynamics 3 (3-0) f s

Prerequisites: ME 521, ME 602

Statistical mechanics as applied to the derivation of the equations of gasdynamics from the microscopic viewpoint. Energy levels of atoms and molecules and their relation to equilibrium thermodynamic concepts, in particular specific heats. Approximate solutions of the Boltzmann Equation. Treatments of viscosity, heat conduction, and electrical conductivity. Collision processes. High temperature behavior of multispecies gas mixtures.

ME 660 Aero-Mechanical Engineering Problems 3 (3-0) s

Prerequisites: ME 402, MA 514

Derivation of governing equations and set up of representative problems in heat transfer, gas dynamics, and magneto-hydrodynamics; review of techniques for solving these problems. Introduction of other techniques such as method of steepest descent, method of Weiner-Hopf. variational methods and others. Phase-space and function space concepts will be introduced also. Purpose of the course in the graduate program is to strengthen the analytical techniques of the students in dealing with aero-mechanical engineering problems so that in their later studies more emphasis may be put on formulation of new problems and physical interpretation of new results.

ME 661, 662 Aerospace Energy Systems 3 (3-0) f s

Prerequisites: MA 512, ME 521, PY 407 or equivalent

A study of energy systems appropriate to the varied requirements of space operations. Includes analysis of chemical, nuclear and solar energy sources and the theory of their adaptation to operational requirements for propulsion and auxiliary power, cooling requirements, coolants and materials.

ME 671, 672 Advanced Air Conditioning Design I, II 3 (3-0) f s

Prerequisites: ME 403, ME 572

The design of heating and air conditioning systems, the preparation of specifications and performance tests on heating and air conditioning equipment.

ME 674, 675 Advanced Spacecraft Design 3 (3-0) f s

Prerequisites: ME 542, ME 582

Analysis and design of spacecraft including system design criteria, acceleration tolerance, entry environment, thermal requirements, criteria for configuration design, aerodynamic design, heating rates, thermostructural design, boost phase, de-orbit, entry corridor, lift modulation, rolling entry, glide phase, maneuvering and landing, stability and control, thermal protection system, materials, instrumentation, and life support systems.

ME 681 Introduction to Rocket Propulsion 3 (3-0) f

Prerequisite: ME 601

Review of the exterior ballistics and performance of rocket propelled vehicles. Thermodynamics of real gases at high temperatures. Non-equilibrium flow in rocket nozzles.

ME 682 Solid Propellant Rockets 3 (3-0) s

Prerequisite: ME 681

A study of the design and performance of solid-propellant rockets; properties and burning characteristics of solid propellants. Internal ballistics of solid-propellant rockets. Design and design optimization. Combustion instabilities.

ME 683 Liquid Propellant Rockets 3 (3-0) s

Prerequisite: ME 681

The study and design of liquid propellant rockets. Combustion of liquid fuels. Thrust chamber, propellant supply and injection system. Cooling of rocket motors. Low and high frequency instability in liquid rocket motors. Scaling laws.

ME 693 Advanced Topics in Mechanical Engineering 1 to 6 credits f or s

Prerequisite: Graduate standing

Faculty and graduate student discussions of advanced topics in contemporary Mechanical Engineering.

ME 695 Mechanical Engineering Seminar 1 (1-0) f or s

Faculty and graduate student discussions centered around current research problems and advanced engineering theories.

ME 699 Mechanical Engineering Research credits by arrangement

Prerequisite: Graduate standing in Mechanical Engineering and approval of advisor

Individual research in the field of Mechanical Engineering.

METALLURGICAL ENGINEERING

COURSES FOR UNDERGRADUATES

MIM 201, 202 Structure and Properties of Engineering Materials I, II 3 (2-3) f s

Prerequisite: CH 103

I. An introduction to the fundamental physical principles governing the structure and constitution of metallic and non-metallic materials of construction, and the relation of these principles to the control of properties.

II. Important applications of engineering materials and criteria for selection of materials.

MIM 331, 332 Physical Metallurgy I, II 3 (3-0) f s

Prerequisites: CH 103, MIM 201

Required of juniors in MTE.

The fundamental principles of physical metallurgy with emphasis on correlation between structure, constitution, and properties of metals and alloys. A systematic development of the metallurgical aspects of atomic and crystalline structure, phase equilibrium, solid solution, diffusion, precipitation hardening, elastic and plastic behavior, and recrystallization.

MIM 401, 402 Metallurgical Operations I, II 4 (3-3) f s

Prerequisite: MIM 332

A systematized treatment of the fundamental operations involved in the production and fabrication of metals and alloys. Part I deals primarily with procedures and operations employed in chemical or extractive metallurgy. Part II covers the operations of physical and mechanical metallurgy.

MIM 421, 422 Metallurgy I, II 2 (2-0) f s

Prerequisite: CH 103

The constitution, structure and properties of engineering ferrous and nonferrous metals and alloys; influences of mechanical working and heat treatment; physical testing, corrosion and its prevention.

MIM 423 Metallurgical Laboratory 1 (0-3) f s

Corequisite: MIM 421 or MIM 422

Laboratory work to accompany Metallurgy I, II.

MIM 431, 432 Metallography I, II 3 (2-3) f s

Prerequisite: MIM 332

An intensive study of the principles and techniques for examination and correlation of the structure, constitution, and properties of metals and alloys.

MIM 491, 492 Metallurgical Engineering Seminar 1 (1-0) f s

Prerequisite: Senior standing in Metallurgical Engineering

Reports and discussion of special topics in metallurgical engineering and related subjects.

MIM 495, 496 Experimental Engineering I, II 3 (1-6) f s

Prerequisite: MIM 422 or approval of instructor

Advanced engineering principles applied to a specific project dealing with metallurgy, metallography, or general experimental work. A seminar period is provided and a written report required.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

MIM 521, 522 Advanced Physical Metallurgy I, II 3 (3-0) f s

Prerequisite: MIM 422 or MIM 432

Theories concerning behavior and control of engineering alloys, reaction rates in the solid state and alloy influences; current heat treating practices, surface treatments; behavior of metals at high and low temperatures; special purpose alloys; powder metallurgy; review of modern equipment and methods for the study of metals.

MIM 523, 524 Metallurgical Factors in Design 3 (3-0) f s

Prerequisite: MIM 422

A study of the metallurgical factors that must be considered in using metals in design.

MIM 541, 542 Principles of Corrosion I, II 3 (2-3) f s

Prerequisite: MIM 422

The fundamentals of metallic corrosion and passivity. The electrochemical nature of corrosive attack, basic forms of corrosion, corrosion rate factors, methods of corrosion protection. Laboratory work included.

MIM 561 Advanced Structure and Properties of Materials 3 (2-3) f

Prerequisite: MIM 422

A systematic treatment of the fundamental physico-chemical principles governing the constitution of both metallic and ceramic materials. Correlation of these principles with physical, mechanical and chemical properties of materials. Particular emphasis is placed upon materials of construction for nuclear reactors. Lecture and laboratory.

MIM 562 Materials Problems in Nuclear Engineering 3 (2-3) s

Prerequisite: MIM 561

Engineering aspects of problems involved in the selection and application of reactor materials. Specific attention is given to elevated temperature behavior, fatigue, corrosion, irradiation damage, and the fabrication and processing of these materials. Lecture and laboratory.

MIM 595, 596 Advanced Metallurgical Experiments I, II 3 (1-6) f s

Prerequisite: MIM 422 or approval of instructor

Advanced engineering principles applied to a specific experimental metallurgical project. A seminar period is provided and a written report is required.

COURSES FOR GRADUATES ONLY

MIM 651, 652 Theory and Structure of Metals 3 (3-0) f s

Prerequisite: MIM 522

An advanced interpretation of the development of theories of the metallic state with emphasis on modern physical concepts. Topics include theory of crystallinity, bonding forces, stability of metallic structures, diffusion, and dislocation theory.

MIM 699 Metallurgical Engineering Research credits by arrangement

An independent investigation of an appropriate problem in Metallurgical Engineering. A report on this investigation is required as a graduate thesis.

MILITARY SCIENCE

THE BASIC COURSE

MS 101 Military Science I 1 (1-1) f

Classroom instruction is given in individual weapons and marksmanship, and organization of the Army. On the drill field, emphasis is placed on development of teamwork, esprit de corps, and essential characteristics of leadership.

MS 102 Military Science I 1 (1-1)s

Prerequisite: MS 101 or equivalent

Classroom instruction is given in the role of United States Army and National Security. On the drill field, emphasis is placed on development of teamwork, esprit de corps, and essential characteristics of leadership.

MS 201 MILITARY SCIENCE II 1 (2-1) f

Prerequisites: MS 101, MS 102 or equivalent

Classroom instruction in American Military History and Counterinsurgency Operations. On the drill field, emphasis is placed on development of teamwork, esprit de corps, essential characteristics of leadership, and acceptance of responsibility.

MS 202 MILITARY SCIENCE II 1 (2-1) s

Prerequisites: MS 101, MS 102, MS 201 or equivalent

Classroom instruction in map and aerial photograph reading and introduction to operations and basic tactics. On the drill field emphasis is placed on development of teamwork, esprit de corps, essential characteristics of leadership, and acceptance of responsibility.

THE ADVANCED COURSE

MS 301 MILITARY SCIENCE III 1 (2-1) f

Prerequisites: MS 101, 102, MS 201, 202 or equivalent

Classroom instruction is given in military leadership, emphasizing the factors controlling the soldier's behavior and the problems of command; branches of the Army, emphasizing the mission of each in order to acquaint students with all branches prior to their ROTC Summer Camp and selection of branch in their senior year; principles of military planning and conduct of offensive and defensive tactics. Practical leadership instruction is provided on the drill field where emphasis is placed on acceptance of responsibility, exercise of command and development of self-confidence, initiative and dignity in appearance and demeanor.

MS 302 MILITARY SCIENCE III 2 (2-1) s

Prerequisite: MS 301

Classroom instruction is given in methods of military teaching with special reference to the leader's responsibility for soldier's learning; continuation of offensive and defensive tactics including communciation in support of military operations; counterinsurgency operations; and a precamp orientation prior to ROTC Summer Camp. Practical leadership instruction is provided in the drill field where emphasis is placed on acceptance of responsibility, exercise of command and development of self-confidence.

MS 401 MILITARY SCIENCE IV 1 (2-1) f

Prerequisites: MS 301, 302, and satisfactory completion of six week's summer camp training

Classroom instruction is given in military justice, troop movement, logistics, intelligence, and operations. On the drill field, emphasis is placed on the exercise of command, planning and executing all phases of training (instruction in basic fundamentals, inspections, ceremonies, and competitions), and maximum development of teamwork, esprit de corps, and leadership characteristics.

MS 402 MILITARY SCIENCE IV 2 (2-1) s

Prerequisite: MS 401

Classroom instruction is given in supply and evacuation, Army administration, role of the United States in world affairs, and service orientation. On the drill field, emphasis is placed on the exercise of command, planning and executing all phases of training (instruction in basic fundamentals, inspections, ceremonies, and competitions), and maximum development of teamwork, esprit de corps, and leadership characteristics.

INERAL INDUSTRIES

See: Ceramic Engineering
Geological Engineering
Metallurgical Engineering

MODERN LANGUAGES

Courses numbered 200 and above need not be followed as a sequence in their respective gamut. Two years of high school languages will normally be considered the equivalent of one year of college instruction in that language. All students registering for a language course will be examined on proficiency and scheduled for the course for which they are fitted.

ENGLISH (Foreign Students)

MLE 101 English for Foreign Students: Review Grammar 3 (3-0) f s

Emphasis in this course is laid upon the pronunciation, grammar and comprehension of American English.

MLE 102 English for Foreign Students: Composition 3 (3-0) f s

Emphasis in this course is laid upon the writing of American English, grammatical exercises, sentence structure, spelling and diction.

MLE 103 English for Foreign Students: Conversation 3 (3-0) f s

Designed for foreign students who have studied formal English but who need oral practice in informal speech to understand it and speak it with ease and fluency. Emphasis placed on correct pronunciation, intonation (rhythm and stress in words and sentences), drill on the basic patterns of English sentences, and idiomatic expressions by means of oral classroom drills, conversations about current issues, and individual and/or supervised practice in the language laboratory.

FRENCH

MLF 101 Elementary French 3 (3-0) f s

MLF 102 French Grammar and Prose Reading 3 (3-0) f s

Prerequisite: MLF 101 or equivalent

MLF 201 French Prose: Selections From Modern French Literature 3 (3-0) f s

Prerequisite: MLF 102 or equivalent

MLF 202 French Civilization 3 (3-0) f s

Prerequisite: MLF 102 or equivalent

After a preliminary survey of the land and people of France, such topics as language, arts, science, literature, philosophy, etc. are given consideration. Parallel readings and reports.

MLF 203 Review Grammar and Composition 3 (3-0) f s

Prerequisite: MLF 102 or equivalent

This course will bridge the gap between basic grammar courses and the more advanced literary courses preparing the student for the type of composition and conversation expected of him in the latter. It will also offer an opportunity for students with previous knowledge of a language from secondary schools to review grammar and obtain experience in an area not normally covered in their high school work.

MLF 301 Survey of French Literature, Origins to 1800 3 (3-0) f s

Prerequisite: 6 hours intermediate French

MLF 302 Survey of French Literature, 1800 to Present 3 (3-0) f s

Prerequisite: 6 hours intermediate French

MLF 401 FRENCH GRAMMAR FOR GRADUATE STUDENTS 3 (3-0) f s

This course is designed to present the grammar of scientific French as rapidly as possible in preparation for the reading course which follows.

MLF 402 SCIENTIFIC FRENCH 3 (3-0) f s

Prerequisite: MLF 401 or equivalent

Reading and translation of technical French, supplemented by discussions on terminology, word order, vocabulary analysis and other linguistic techniques. Subject material adjusted to individual needs; conferences.

GERMAN

MLG 101 ELEMENTARY GERMAN 3 (3-0) f s

MLG 102 GERMAN GRAMMAR AND PROSE READING 3 (3-0) f s

Prerequisite: MLG 101 or equivalent

MLG 201 GERMAN PROSE: SELECTIONS FROM MODERN GERMAN LITERATURE 3 (3-0) f s

Prerequisite: MLG 102 or equivalent

MLG 202 GERMAN CIVILIZATION 3 (3-0) f s

Prerequisite: MLG 102 or equivalent

Readings in the history and customs of Germany, supplemented by lectures on such topics as language, arts, science, philosophy, etc. Parallel readings and reports.

MLG 203 REVIEW GRAMMAR AND COMPOSITION 3 (3-0) f s

Prerequisite: MLG 102 or equivalent

This course will bridge the gap between basic grammar courses and the more advanced literary courses preparing the student for the type of composition and conversation expected of him in the latter. It will also offer an opportunity for students with previous knowledge of a language from secondary schools to review grammar and obtain experience in an area not normally covered in their high school work.

MLG 301 SURVEY OF GERMAN LITERATURE, ORIGINS TO 1900 3 (3-0) f s

Prerequisite: 6 hours intermediate German

MLG 302 SURVEY OF GERMAN LITERATURE, 1900 TO PRESENT 3 (3-0) f s

Prerequisite: 6 hours intermediate German

MLG 401 GERMAN GRAMMAR FOR GRADUATE STUDENTS 3 (3-0) f s

This course is open to graduate students and senior honors students and is designed to present the grammar of scientific German as rapidly as possible in preparation for the reading course which follows.

MLG 402 SCIENTIFIC GERMAN 3 (3-0) f s

Prerequisite: MLG 401 or equivalent

Reading and translation of technical German, supplemented by discussions on terminology, word order, vocabulary analysis and other linguistic techniques. Subject material adjusted to individual needs; conferences.

ITALIAN

MLI 101 ELEMENTARY ITALIAN 3 (3-0) f s

MLI 102 ITALIAN GRAMMAR AND PROSE READING 3 (3-0) f s

Prerequisite: MLI 101 or equivalent

RUSSIAN

MLR 101 Elementary Russian 3 (3-0) f s

MLR 102 Russian Grammar and Prose Reading 3 (3-0) f s
Prerequisite: MLR 101 or equivalent

MLR 201 Russian Prose: Selections From Russian Literature 3 (3-0) f s
Prerequisite: MLR 102 or equivalent

MLR 202 Russian Civilization 3 (3-0) f s
Prerequisite: MLR 102 or equivalent
Reading in Russian covering the history, politics, customs, and culture of Russia. Emphasis given to accurate translation from Russian to English. Parallel readings and reports.

SPANISH

MLS 101 Elementary Spanish 3 (3-0) f s

MLS 102 Spanish Grammar and Prose Reading 3 (3-0) f s
Prerequisite: MLS 101 or equivalent

MLS 201 Spanish Civilization 3 (3-0) f s
Prerequisite: MLS 102 or equivalent
Comprehensive picture of the culture, geography, history, and economy of Spain.

MLS 202 Hispano-American Civilization 3 (3-0) f s
Prerequisite: MLS 102 or equivalent
Comprehensive picture of the culture, geography, history and economy of the Spanish American countries.

MLS 203 Review Grammar and Composition 3 (3-0) f s
Prerequisite: MLS 102 or equivalent
This course will bridge the gap between basic grammar courses and the more advanced literary courses preparing the student for the type of composition and conversation expected of him in the latter. It will also offer an opportunity for students with previous knowledge of a language from secondary schools to review grammar and obtain experience in an area not normally covered in their high school work.

MLS 301 Survey of Spanish Literature, Origins Through Golden Age 3 (3-0) f s
Prerequisite: 6 hours intermediate Spanish

MLS 302 Survey of Spanish Literature, 18th Century to Present 3 (3-0) f s
Prerequisite: 6 hours intermediate Spanish

MLS 401 Spanish Grammar for Graduate Students 3 (3-0) f s
This course is designed to present the grammar of scientific Spanish as rapidly as possible in preparation for the reading course which follows.

MLS 402 Scientific Spanish 3 (3-0) f s

Prerequisite: MLS 401 or equivalent

Reading and translation of technical Spanish, supplemented by discussion on terminology, word order, vocabulary analysis and other linguistic techniques. Subject material adjusted to individual needs; conferences.

GENERAL COURSES

ML 321, 322 Romance Literature 2 (2-0) s

Prerequisite: Junior or senior standing

A course cutting across language barriers to illustrate the most outstanding literary productions of France, Spain, Italy, and Portugal and showing the cultural and social pattern of these nationalities having a common language inheritance. Selected readings and reports.

ML 323, 324 Germanic Literature 2 (2-0) s

Prerequisite: Junior or senior standing

A study of the literary productions in each of the various types of Germanic literature, and lectures on their cultural background. Designed primarily to meet the needs of students who wish to supplement their knowledge of their own literature with that of the literature of other civilizations. Attention is given to the literary monuments of Germany, Holland, Denmark, Iceland, and the Scandinavian countries. No foreign language prerequisites.

MUSIC

MUS 100 Band 1 (5-0) f s

Prerequisite: Approval of conductor

Open to all students for the study and performance of the best band literature through concert appearances. Assignments to the Symphonic Band, the Fanfare Band and the Marching Band are made according to the interests and abilities of the individual.

MUS 200 Music in Our Contemporary Life 3 (3-0) s

A course especially designed to assist students in developing their understanding of music as a vital part in today's life. Special emphasis on evaluating musical form and content, style periods, design and interpreting music as it relates to various aspects of today's society.

MUS 210 A Survey of Music in America 3 (3-0) s s

A survey of the music in the United States from colonial times to the present, with particular emphasis on the major influences which have shaped the musical literature and culture of America.

MUS 220 Musical Literature of the Romantic Period 3 (3-0) s s

A course designed to provide an insight into the significant musical forms of the Romantic Period. Subject matter will include an analysis of the music literature of the prevailing forms, the styles of the composers and the relation of music to other romantic art forms.

NUCLEAR ENGINEERING

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

NE 404 Nuclear Energy Conversion I 3 (3-0) s

Prerequisite: CHE 421 or equivalent

Basic principles of the transformation of nuclear energy into useful

forms. Considers the reactor as a heat source for a heat engine cycle. Description and analysis of various reactor concepts and associated power plants. Mr. Carnesale

NE 405 Nuclear Energy Conversion II 3 (3-0) f

Prerequisite: CHE 422 or equivalent

Basic principles of the transformation of nuclear energy into useful forms. Considers isotope production and utilization, direct conversion techniques, nuclear propulsion concepts, research reactors, and breeder reactors. Mr. Saxe

NE 419 Introduction to Nuclear Engineering 3 (3-0) f

Prerequisite: PY 407

A survey of nuclear energy applications, including nuclear reactor materials, reactor theory, shielding, thermal and hydraulic analysis, and control. Uses of nuclear fission and its by-products in research, industry, and propulsion are reviewed. The major engineering problems are defined and methods of approach are outlined. Mr. Carnesale

NE 501 Nuclear Reactor Theory I 3 (3-0) f

Corequisite: PY 410

An introductory course in reactor theory including the fission process, neutron energy distribution, lethargy, neutron slowing and interactions, diffusion, Fermi age theory, the diffusion equation, criticality conditions, and reactor instrumentation. Mr. Verghese

NE 502 Nuclear Reactor Theory II 3 (3-0) s

Prerequisite: NE 501

Continuation of reactor theory from NE 501. Topics include: treatment of reactor parameters for homogeneous and heterogeneous reactors, reflected reactors, multi-group theory, reactor kinetics, temperature effects, control rod theory, perturbation theory, and transport theory. Mr. Verghese

NE 503 Nuclear Engineering Systems 3 (3-0) s

Prerequisite: NE 501

Considers reactor as a system including aspects of reactor control, radiation protection, shielding, and thermal design. Mr. Carnesale

NE 511 Radiation Detection and Analysis 3 credits f s

Prerequisite: PY 410

Interaction of radiation with detectors. Characteristics of detectors and analysis equipment. Statistics of the counting process. Emphasis is on preparation for use of radiation counting equipment for research. Mr. Verghese

NE 518 Radiological Safety 3 (3-0) s

Prerequisites: PY 410, NE 501

Brief treatment of types of radiation and their interaction with matter, shielding and biological effects. More detailed study of safety considerations in a nuclear installation, including regulations, instrumentation used, overall detection system, emergency situations, and radiation containment. An attempt will be made to gain an overall picture of the safety considerations in a nuclear installation. Mr. Elleman

NE 520 Nuclear Radiation Shielding 3 (3-0) f

Prerequisite: NE 503

This course will cover an introduction to radiation protection criteria, design of shields for attenuation of gamma rays and neutrons from reactor

primary systems and other sources and shield materials. Machine computation techniques will be discussed whenever necessary. The latter part of the semester will be utilized to carry out special problems in the design of space-radiation shields, hot cells and fall-out shelters. Mr. Carnesale

NE 530 Introduction to Nuclear Reactor Theory 3 (3-0) s

Prerequisite: PY 410

The principles of neutron motion in matter, with emphasis on the analysis of the nuclear chain reactor. Slowing of neutrons, diffusion, space distributions of flux, conditions for criticality, group theories, and the time-dependent behavior of fissionable assemblies. Mr. Elleman

NE 531 Nuclear Reactor Laboratory 2 (0-6) s

Prerequisite: NE 530 or NE 501

Observation and measurements of static and dynamic nuclear reactor behavior, the effectiveness of control and temperature, and correlation with theory. Experiments on the motion and detection of neutrons and gamma rays, with emphasis on the research uses of nuclear reactor radiations.
Mr. Leonard

NE 532 Nuclear Engineering Laboratory 2 (0-6) f

Prerequisite: NE 501 or equivalent

This laboratory course will provide a series of experiments that are fundamental to Nuclear Engineering. Special emphasis will be on experiments related to nuclear reactor theory, reactor kinetics, neutron physics, reactor heat transfer and radiochemistry applications. Several experiments in conjunction with an analog computer will be performed. Familarization with research equipment will be gained through active participation of the student in setting up the various measurements.
Messrs. Leonard, Saxe

NE 540 Nuclear Reactor Control 3 (3-0) s

Prerequisite: NE 502 or NE 530

Considers non-steady-state reactor behavior including reactivity effects due to temperature, poisoning, and control rods. Uses elementary servomechanism theory in treating reactor as a control element. Treats automatic control including control mechanism and dynamic effects of power plant characteristics.
Messrs. Leonard, Saxe

NE 545 Nuclear Reactor Kinetics 3 (3-0) f

Prerequisite: NE 502 or NE 530

The kinetic behavior of nuclear reactors is carefully analyzed from both theoretical and experimental viewpoints. Solutions of the basic kinetic equations are developed and applied to specific reactor behavior. Temperature, void and xenon poisoning effects are considered. Digital and analog computer techniques are discussed and utilized. Correlation of theory with observed reactor behavior is made and safety considerations in reactor design are discussed. Messrs. Leonard, Saxe

NE 550 Radiation Utilization 3 (3-0) f

Prerequisites: PY 410, NE 511 or equivalent

Theory, industrial application and economics of nuclear radiation are discussed. Emphasis is on the ability to choose appropriate forms of radiation and to design practical equipment. Subjects covered include: origin and economics of radiation, tracer techniques, activation analysis, food irradiation, chemonuclear processing, low and high level sealed source devices, and unique engineering aspects. Messrs. Ely, Welt

NE 570 Radiation Effects on Materials 3 (3-0) f

Prerequisites: MIM 201, PY 407

A study of the interactions of different types of radiation with matter, with emphasis on the physical effects. Current theories will be evaluated and experimental techniques will be discussed. Annealing of defects and radiation induced changes in physical properties will be investigated in detail. Mr. Elleman

NE 591, 592 Special Topics in Nuclear Engineering I, II 1 to 3 f s

Prerequisite: Consent of instructor

These courses will be used to explore unusual and/or specialized areas of Nuclear Engineering. Graduate Staff

COURSES FOR GRADUATES ONLY

NE 619 Reactor Theory and Analysis I 3 (3-0) f

Prerequisite: NE 502 or NE 530

The theory of neutron slowing, resonance capture, Doppler effect, and thermal flux distributions in heterogeneous nuclear reactors. Analysis of reactor control by temperature effects, localized and distributed absorbers, fission products, fuel consumption and production. One-velocity neutron transport theory. Mr. Murray

NE 620 Nuclear Radiation Attenuation 3 (3-0) f

Prerequisites: NE 503 or NE 530 or PY 510, MA 512

The physical theory and mathematical treatment of the penetration of neutrons, gamma-rays, and charged particles in matter. Gamma-ray transport theory. Analysis of experimental methods for obtaining penetration data. Graduate Staff

NE 630 Reactor Theory and Analysis II 3 (3-0) s

Prerequisite: NE 502 or NE 530

The theory of neutron multiplication in uniform media with several dimensions, regions, and neutron energy groups. Reactor control by absorbers, time dependent reactor behavior, matrix treatment of perturbation theory, neutron thermalization, energy dependent neutron transport theory, and multigroup machine methods. Mr. Murray

NE 651 Advanced Reactor Theory 3 credits f

Prerequisites: NE 619, NE 630

A presentation of the latest advances in the mathematical analysis of nuclear reactor systems behavior, with special emphasis on neutron theory. Investigations of new reactor concepts, the development of experimental measurement techniques and methods of interpretation. Evaluation of computer methods for design calculations. Graduate Staff

NE 653 Nuclear Reactor Design 3 credits s

Corequisites: NE 619, NE 630

A comprehensive analysis and design of a nuclear reactor system for a specified application will be performed. Considerations will include criticality, control, lifetime, thermal-hydraulic, shielding, economics, power conversion, and optimization procedures. Selected application will be varied each year. Graduate Staff

NE 691, 692 Advanced Topics in Nuclear Engineering I, II 1 to 3 f s

Prerequisite: Consent of instructor

A study of recent developments in Nuclear Engineering theory and practice. Graduate Staff

NE 695 SEMINAR 1 (1-0) f s

Discussion of selected topics in Nuclear Engineering.

Graduate Staff

NE 699 RESEARCH credits by arrangement

Individual research in the field of Nuclear Engineering.

Graduate Staff

OCCUPATIONAL INFORMATION AND GUIDANCE

COURSES FOR UNDERGRADUATES

ED 420 PRINCIPLES OF GUIDANCE 2 (2-0) f s

This is a course designed to provide basic principles of guidance for teachers, teacher-counselors, administrators, and others in the school, as well as workers in other areas such as the community agency, business, industry, group work, and the like.

Among the topics covered are need for guidance; bases of guidance services; programs of studying the individual; counseling for educational, vocational, social, and personal problems; group procedures in guidance. Emphasis is on the practical application of guidance principles and procedures.

Mr. Morehead

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

ED 520 PERSONNEL AND GUIDANCE SERVICES 3 (3-0) f

Prerequisites: Six hours of Education or Psychology

An introduction to the philosophies, theories, principles, and practices of personnel and guidance services; the relationship of personnel services with the purposes and objectives of the school and the curriculum.

Mr. Morehead

ED 524 OCCUPATIONAL INFORMATION 3 (3-0) s

Prerequisites: Six hours of Education or Psychology, ED 520 or equivalent

This course is intended to give teachers, counselors, placement workers, and personnel workers in business and industry an understanding of how to collect, classify, evaluate, and use occupational and educational information. This will include a study of the world of work, sources of occupational information, establishing an educational-occupational information library, using educational, occupational, and social information, and sociological and psychological factors influencing career planning.

Mr. Morehead

ED 530 GROUP GUIDANCE 3 (3-0) f

Prerequisites: Six hours of Education or Psychology, ED 520 or equivalent

This course is designed to help teachers, counselors, administrators, and others who work with groups, or who are responsible for group guidance activities, to understand the theory and principles of effective group work, to develop skill in using specific guidance techniques, and to plan and organize group activities in secondary schools and other institutions.

Mr. Morehead

ED 533 ORGANIZATION AND ADMINISTRATION OF GUIDANCE SERVICES 3 (3-0) s

Prerequisites: Graduate standing, ED 520 or equivalent

This course is designed for school guidance counselors, prospective counselors, personnel and guidance directors, and school administrators. The

philosophy and scope of guidance and personnel services; the functions and responsibilities of personnel involved; basic principles and current practices in planning, developing, operating and supervising guidance and personnel services will be studied. Administrative relationships, utilization of school staff, interrelationships of guidance services with instruction, and evaluation of guidance services will be considered. Mr. Morehead

ED 590 Individual Problems in Guidance maximum 6

Prerequisite: Six hours graduate work in department or equivalent

Intended for individual or group studies of one or more of the major problems in guidance and personnel work. Problems will be selected to meet the interests of individuals. The workshop procedure will be used whereby special projects and reports will be developed by individuals and by groups.
Messrs. Anderson, Morehead

COURSES FOR GRADUATES ONLY

ED 631 Educational and Vocational Guidance 3 (3-0) f

Prerequisite: Nine hours from following fields—Economics, Education, Psychology or Sociology

This course aims to provide training for teachers who are part-time or full-time counselors, employment interviewers, social workers and personnel workers, who are aiding individuals with vocational adjustment problems. The course will cover the functions performed in vocational and educational guidance such as assembling and imparting occupational information, counseling regarding vocational and educational plans, the use of aptitude tests, placement in jobs and follow-up, and procedures in setting up services of vocational and educational guidance in schools, employment offices, and social services agencies. Mr. Anderson

ED 633 Techniques of Counseling 3 (3-0) s

Prerequisite: Nine hours from following fields—Economics, Education, Psychology or Sociology

This course is designed to aid the personnel worker in the secondary school, college, employment office, or social agency to develop an understanding and to develop skill in counseling techniques; philosophies, theories, principles and practices of counseling will be considered. Students will become acquainted with counseling techniques through lectures, demonstrations, case histories and tape recordings. Attention will be given to both diagnosis and treatment. Mr. Anderson

ED 641 Laboratory and Practicum Experiences in Counseling 2-6 credits

Prerequisite: Advanced graduate standing

A practicum course in which the student participates in actual counseling experience under supervision in a school, college, social service agency, employment office, or business or industrial establishment. The student may observe and participate in some personnel and guidance services and may study the organization and administration of the program.
Messrs. Anderson, Morehead

ED 699 Research maximum 6

Prerequisites: 15 credits and permission of advisor

Individual research on a specific problem of concern to the student.
Messrs. Anderson, Morehead

PHILOSOPHY AND RELIGION

COURSES FOR UNDERGRADUATES

PHI 201 Logic 3 (3-0) f s

Language as symbol system, the formal structure of reasoning, and characteristics of empirical knowledge; emphasis on the establishment of reflective habits.

PHI 205 Problems and Types of Philosophy 3 (3-0) f s

The great philosophers of the western world, the socio-cultural heritage in which they worked, their major concerns and conclusions; the relation of philosophy to vital questions of human life.

REL 301 Religion in American Life 3 (3-0) f s

The major religious groups in America: their historical development, organization, beliefs and practices, social and moral teachings; the confrontation of religion and contemporary American life: the relevance of religion to contemporary political, economic, social and cultural issues.

REL 302 The Bible and Its Background 3 (3-0) f s

Background of the Bible: origin, growth and development of central concepts, leading personalities, and the process by which it has come to us as viewed in the light of modern scholarship.

REL 303 Christian Ethics 2 (2-0) f s

An analysis of the major areas of modern life in the light of the ethical teachings of Christianity, with an examination of the religious faith upon which these teachings rest.

PHI 304 (ED 304) Philosophy of Education 3 (3-0) f s

Implications of various philosophical viewpoints, especially in value theory, social-political philosophy, and theory of knowledge, for the aims and procedures of education; study of the relevant work of the principal contributors to the Western intellectual tradition from Plato to the present.

PHI 305 Philosophy of Religion 3 (3-0) f s

Psychological and historical roots of religious belief; science, philosophy, and religion; the rational foundations of theism; the concept of God in Western thought.

PHI 306 Philosophy of Art 3 (3-0) f s

Study of historical and contemporary theories of art; development of coherent set of concepts for analysis and discussion of esthetic experience, critical judgments, works of art and their relations to other aspects of culture.

PHI 307 Ethics 3 (3-0) f s

Study of major ethical theories; systematic analysis of the nature of value judgments, and the concepts of moral obligation, right and good; personal and social aspects of human conduct.

PHI 309 Marriage and Family Living 3 (3-0) f s

Secular and religious concepts of marriage; physical, socio-psychological, and ethical aspects of premarital and marital relationships; parenthood; critical analysis of value judgments relative to marriage and family living; formulation of philosophy of marriage.

PHI 311 Parent-Child Relationships 2 (2-0) f s

Principles of inter-personal relationships; democratic values and the attainment of growth by parent and child through freedom, responsibility, and

creative activity; analysis of current theories of husband-wife, and parent-child relationships.

PHI 320 Early Western Philosophy 3 (3-0) f s

Selective survey of major philosophers and philosophical movements in Western civilization from the pre-Socratics of ancient Greece to the scientific revolution in the 17th century.

PHI 321 Modern Western Philosophy 3 (3-0) f s

Selective survey of major philosophers and philosophical movements in Western civilization from the 17th century to the 20th century.

PHI 395 Philosophical Analysis 3 (3-0) f s

Semantical, logical, and experiential methods of investigation; intensive application of critical inquiry to a few fundamental problems including the nature of knowledge and its validation, and value judgment; major objective to afford personal participation in and acquaintance with philosophical analysis as intellectual tool with wide applicability.

PHI 401 Symbolic Logic 3 (3-0) f s

Modern methods in logic involving formalized expression that avoids inherent difficulties and ambiguities of ordinary language and makes possible greater effectiveness in handling complex material.

REL 403 Religions of the World 3 (3-0) f s

Background, general characteristics, and basic teachings of the major living religions of the world; consideration of contemporary secular movements that are in a sense religions.

PHI 405 Foundations of Science 3 (3-0) f s

Nature and validity of knowledge, basic concepts of modern science, scientific method, and the implications of the philosophy of modern science for ethics, social philosophy, and the nature of reality.

PHI 407 Theory of Knowledge 3 (3-0) f s

A critical analysis of the principal traditional and contemporary theories of knowledge, including discussion of the types of knowledge, the methods of obtaining knowledge, the nature and criteria of meaning, the nature and criteria of truth, the nature of the objects of knowledge, the relationship of language to knowledge.

PHI 490 Seminar 3 (0-3) f s

Prerequisite: Six credits in Philosophy

Advanced level study in one problem area in philosophy, selected by instructor, with special attention to areas not represented elsewhere in the program, such as metaphysics, social and political philosophy, philosophy of history, philosophy of language. Emphasis on oral and written philosophical discussion by student.

PHI 491 Seminar 3 (0-3) f s

Prerequisites: Six credits in Philosophy

Advanced level study in the work of an outstanding individual figure or movement in the history of philosophy, including the contemporary period, selected by instructor. Extensive selections from original sources. Emphasis on oral and written philosophical discussion by student.

PHI 499 Senior Essay 3 (0-3) f s

Prerequisites: Twelve credits in Philosophy or approval of department

Individually directed research and critical written analysis on a topic chosen in consultation with staff advisor. Emphasis on intensive treatment

of a well-defined, limited topic in the thought of a major philosopher or in the literature on one of the main problems of philosophy.

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

REL 502 Problems of Religion 3 (3-0) f s

Prerequisite: Six credits in Religion or related fields

Major trends in contemporary theology; significance of the resurgent interest in religion and the growth of the church in recent times; problem of communication between theology and science; the ecumenical movement.

PHYSICAL EDUCATION

PRESCRIBED COURSES

PE 111 Hygiene 1 (2-0) f s

A course designed to meet the health knowledge requirements and to guide the student to a more healthful way of life.

PE 112 Beginning Swimming I 1 (0-2) f s

A course for non-swimmers which is designed for meeting the University swimming requirements and for preparing the student to take Beginning Swimming II.

PE 212 Beginning Swimming I 1 (0-2) f s

The same as PE 112; except, this course is for sophomores or those students who have already received credit for two semesters of physical education.

PE 113 Beginning Swimming II 1 (0-2) f s

A course for very weak swimmers. It is designed for meeting the University swimming requirement and for preparing the freshman to take the intermediate swimming course.

PE 213 Beginning Swimming II 1 (0-2) f s

The same as PE 113; except, this course is for sophomores or those students who have already received credit for two semesters of physical education.

PE 313 Beginning Swimming II 1 (0-2) f s

The same as PE 113; except, this course is for students who desire to learn to swim and do not have a physical education requirement to meet.

PE 114 Fundamental Sports I 1 (0-2) f s

A course designed for freshmen with low motor skill where a particular type of activity may be offered to meet individual needs.

PE 115 Fundamental Sports II 1 (0-2) f s

Prerequisite: PE 114

This course is a follow-up of PE 114.

PE 116 Soccer 1 (0-2) f

A course designed to acquaint the student with the fundamental skill of the game and to offer the values of a vigorous outdoor team sport.

PE 216 Soccer 1 (0-2) f

The same as PE 116; except, this course is for sophomores or those students who have already received credit for two semester of physical education.

PE 117 Gymnastics I 1 (0-2) f s

A course designed for teaching the fundamentals of gymnastics on the parallel bars, side horse, trampoline, and mats.

PE 217 Gymnastics I 1 (0-2) f s

The same as PE 117; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 118 Restricted Activity I 1 (0-2) f s

A course designed specifically to meet the needs of those individuals who have temporary or permanent physical impairments. Students entering this program must obtain a restrictive form from the Student Health Service.

PE 218 Restricted Activity I 1 (0-2) f s

The same as PE 118; except, this course is for sophomores or those students who have already received credit for two semesters of physical education.

PE 119 Restricted Activity II 1 (0-2) f s

Prerequisite: PE 118

This course is a follow-up of PE 118.

PE 219 Restricted Activity II 1 (0-2) f s

Prerequisite: PE 118 or PE 218

The same as PE 119; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

CONTROLLED ELECTIVE COURSES

AQUATICS

PE 121 Intermediate Swimming 1 (0-2) f s

A course designed to give the student competence in four basic strokes and two dives.

PE 221 Intermediate Swimming 1 (0-2) f s

The same as PE 121; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 321 Intermediate Swimming 1 (0-2) f s

The same as PE 121; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 122 Water Sports 1 (0-2) s

A course to teach the skills of water polo and water basketball, plus improvement in stamina and water skills.

PE 222 Water Sports 1 (0-2) s

The same as PE 122; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 322 Water Sports 1 (0-2) s

The same as PE 122; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 123 Senior Life Saving 1 (0-2) f s

Prerequisite: PE 121 or equivalent

A course designed to qualify students for a Senior Red Cross Life Saving certificate.

PE 223 Senior Life Saving 1 (0-2) f s

The same as PE 123; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 323 Senior Life Saving 1 (0-2) f s

The same as PE 123; except, this course is for students who are taking a physical education course beyond the two year requirement.

PE 124 Water Safety Instructors 1 (0-2) f s

Prerequisite: PE 123 or equivalent

A course designed to qualify students for a Red Cross Water Safety Instructor's rating.

PE 224 Water Safety Instructors 1 (0-2) f s

The same as PE 124; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 324 Water Safety Instructors 1 (0-2) f s

The same as PE 124; except, this course is for students who are taking a physical education course beyond the two year requirement.

DEVELOPMENTAL ACTIVITIES

PE 131 Body Mechanics I (Girls only) 1 (0-2) f s

A course designed to direct the student in a program of physical development and coordinated movement.

PE 231 Body Mechanics I (Girls only) 1 (0-2) f s

The same as PE 131; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 132 Body Mechanics II (Girls only) 1 (0-2) f s

Prerequisite: PE 131 or equivalent.

This course is a follow-up of PE 131 with a greater emphasis on rhythmic activity.

PE 232 Body Mechanics II (Girls only) 1 (0-2) f s

The same as PE 132; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 133 Boxing 1 (0-2) f s

A course designed to acquaint the student with the fundamentals, skills, history, and rules, with special emphasis on defensive techniques.

PE 233 Boxing 1 (0-2) f s

The same as PE 133; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 333 Boxing 1 (0-2) f s

The same as PE 133; except, this course is for students who are taking a physical education course beyond the two year requirement.

PE 134 GYMNASTICS II 1 (0-2) f s

Prerequisite: PE 117 or equivalent

This course is a follow-up of PE 117 with a primary emphasis on leadership training.

PE 234 GYMNASTICS II 1 (0-2) f s

The same as PE 134; except, this course is for sophomores or those stustudents who have received credit for two semesters of physical education.

PE 235 GYMNASTICS III 1 (0-2) f s

Prerequisite: PE 117 or equivalent.

An advanced gymnastics course with more advanced stunts on the equipment used in Gymnastics I, plus work with the rings and horizontal bar.

PE 335 GYMNASTICS III 1 (0-2) f s

The same as PE 235; except, this course is for students who are taking a physical education course beyond the two year requirement.

PE 136 TRACK AND FIELD 1 (0-2) f s

A course designed to develop knowledge, skill, and interest in track and field events.

PE 236 TRACK AND FIELD 1 (0-2) f s

The same as PE 136; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 336 TRACK AND FIELD 1 (0-2) f s

The same as PE 136; except, this course is for students who are taking a physical education course beyond the two year requirement.

PE 137 WEIGHT TRAINING 1 (0-2) f s

A course designed for teaching the basic skills of body development through weight training. The student should gain knowledge of the principles of strength development and improve himself physically.

PE 237 WEIGHT TRAINING 1 (0-2) f s

The same as PE 137; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 337 WEIGHT TRAINING 1 (0-2) f s

The same as PE 137; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 138 WRESTLING 1 (0-2) f s

A course designed to teach the fundamental skills, history, and rules of wrestling and the values of regular exercise.

PE 238 WRESTLING 1 (0-2) f s

The same as PE 138; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 338 WRESTLING 1 (0-2) f s

The same as PE 138; except, this course is for students who are taking physical education courses beyond the two year requirement.

INDIVIDUAL SPORTS

PE 141 ANGLING 1 (0-2) f s

A course designed to teach the fundamental skills of spin, fly, and bait casting and an understanding of game fishing.

PE 241 ANGLING 1 (0-2) f s

The same as PE 141; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 341 ANGLING 1 (0-2) f s

The same as PE 141; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 142 BADMINTON 1 (0-2) f s

A course designed to give the beginner skill in the basic strokes and a general knowledge of the history, rules, and strategy of the game.

PE 242 BADMINTON 1 (0-2) f s

The same as PE 142; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 342 BADMINTON 1 (0-2) f s

The same as PE 142; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 143 BOWLING 1 (0-2) f s

The fundamentals of ball selection, grips, stance, and delivery are taught along with rules, history, scoring, and the general theory of spare coverage.

PE 243 BOWLING 1 (0-2) f s

The same as PE 143; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 343 BOWLING 1 (0-2) f s

The same as PE 143; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 144 FENCING 1 (0-2) f s

A course designed to teach the basic fundamentals, skills, techniques, and rules of fencing.

PE 244 FENCING 1 (0-2) f s

The same as PE 144; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 344 FENCING 1 (0-2) f s

The same as PE 144; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 145 GOLF 1 (0-2) f s

A course designed for teaching beginners the grip, stance, swing, and use of the various clubs, along with the history and etiquette of play.

PE 245 GOLF 1 (0-2) f s

The same as PE 145; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 345 GOLF 1 (0-2) f s

The same as PE 145; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 146 HANDBALL 1 (0-2) f s

A course designed to include the fundamental skills, together with the history and rules of handball.

PE 246 HANDBALL 1 (0-2) f s

The same as PE 146; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 346 HANDBALL 1 (0-2) f s

The same as PE 146; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 147 ROLLER SKATING 1 (0-2) f s

A course designed to teach the fundamental skills of roller skating, with the emphasis on balance and body control.

PE 247 ROLLER SKATING 1 (0-2) f s

The same as PE 147; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 347 ROLLER SKATING 1 (0-2) f s

The same as PE 147; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 148 SQUASH 1 (0-2) f s

A course designed to include the fundamental skills, together with the history and rules of squash.

PE 248 SQUASH 1 (0-2) f s

The same as PE 148; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 348 SQUASH 1 (0-2) f s

The same as PE 148; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 149 TENNIS I 1 (0-2) f s

A course designed to give beginners a thorough knowledge of the history, rules, and strategy, as well as the fundamental skills, of tennis.

PE 249 TENNIS I 1 (0-2) f s

The same as PE 149; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 349 TENNIS I 1 (0-2) f s

The same as PE 149; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 250 TENNIS II 1 (0-2) f s

Prerequisite: PE 149 or equivalent

This course is a follow-up of PE 149 with emphasis on game strategy and doubles play.

PE 350 TENNIS II 1 (0-2) s

The same as PE 250; except, this course is for students who are taking physical education courses beyond the two year requirement.

TEAM SPORTS

PE 161 BASKETBALL 1 (0-2) f s

A course designed to teach the history, rules, and strategy, as well as the fundamental skills, of basketball.

PE 261 BASKETBALL 1 (0-2) f s

The same as PE 161; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 361 BASKETBALL 1 (0-2) f s

The same as PE 161; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 162 BASKETBALL (Girls only) 1 (0-2) f s

A course designed to teach girls history, rules, and strategy, as well as the fundamental skills, of basketball.

PE 262 BASKETBALL (Girls only) 1 (0-2) f s

The same as PE 162; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 163 FIELD HOCKEY (Girls only) 1 (0-2) s

A course designed to teach girls the history, rules, and strategy, as well as the fundamental skills, of field hockey.

PE 263 FIELD HOCKEY (Girls only) 1 (0-2) s

The same as PE 163; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 164 SOCCER (Girls only) 1 (0-2) f

A course designed to teach girls the history, rules, and strategy, as well as the fundamental skills, of soccer.

PE 264 SOCCER (Girls only) 1 (0-2) f

The same as PE 164; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 165 SOFTBALL 1 (0-2) s

A course designed to include the fundamental skills, history, and rules of the game.

PE 265 SOFTBALL 1 (0-2) s

The same as PE 165; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 365 SOFTBALL 1 (0-2) s

The same as PE 165; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 166 SPEEDBALL 1 (0-2) s

A course designed to include the fundamental skills, history, and rules of speedball.

PE 266 SPEEDBALL 1 (0-2) s

The same as PE 166; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 366 SPEEDBALL 1 (0-2) s

The same as PE 166; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 167 TOUCH FOOTBALL 1 (0-2) f

A course designed to include the fundamental skills, history, rules, and strategy of touch football.

PE 267 TOUCH FOOTBALL 1 (0-2) f

The same as PE 167; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 367 TOUCH FOOTBALL 1 (0-2) f

The same as PE 167; except, this course is for students who are taking physical education courses beyond the two year requirement.

PE 168 TOUCH FOOTBALL (Girls only) 1 (0-2) f

A course designed to teach girls the fundamental skills, history, rules, and strategy of the game.

PE 268 TOUCH FOOTBALL (Girls only) 1 (0-2) f

The same as PE 168; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 169 VOLLEYBALL 1 (0-2) f s

A course designed to include the fundamental skills, history, rules, and strategy of the game.

PE 269 VOLLEYBALL 1 (0-2) f s

The same as PE 169; except, this course is for sophomores or those students who have received credit for two semesters of physical education.

PE 369 VOLLEYBALL 1 (0-2) f s

The same as PE 169; except, this course is for students who are taking a physical education course beyond the two year requirement.

VARSITY SPORTS

PE 171 VARSITY SPORTS I 1 (0-2) f s

This course is for freshman students who are transferring to a varsity sport for a term (8 weeks) for the first time.

PE 172 VARSITY SPORTS II 1 (0-2) f s

This course is for freshmen students who are making their second transfer to a varsity sport.

PE 273 VARSITY SPORTS III 1 (0-2) f s

This course is for sophomores or those students who have received credit for two semesters of physical education and are transferring to a varsity sport.

PE 274 VARSITY SPORTS IV 1 (0-2) f s

This course is for sophomores or those students who have received credit for two semesters of physical education and are making their second transfer as a sophomore.

PHYSICAL SCIENCES AND APPLIED MATHEMATICS

PSM 100 ORIENTATION 0 (1-0) f

Introduction to the fields of the physical sciences and mathematics. Required of all new freshmen in the School. Staff

PHYSICS

COURSES FOR UNDERGRADUATES

PY 205, 208 General Physics 4 (2-4) f s; 5 (3-4) f s

Corequisite: MA 201

This sequence is required in most engineering curricula. A study of classical and modern physics in which the analytical approach is employed and calculus is applied as needed. Demonstration lectures, recitations, problem drill, and laboratory work are coordinated to give a working knowledge of basic principles. PY 205, mechanics, sound, and heat; PY 208, electricity, light, and modern physics. Staff

PY 205, 206, 207 General Physics 4 (2-4) s; f; s

Corequisite: MA 201

This sequence is intended primarily for majors in departments of the School of Physical Sciences and Applied Mathematics and the Department of Nuclear Engineering. Calculus is used throughout as needed. These courses are intended to give a good foundation for further study in the physical sciences.

PY 211, 212 General Physics 4 (3-3) f s; f s

Prerequisite: MA 111

A survey of general physics designed to provide a practical understanding of the fundamentals on which technology is based. Recitations, demonstrations, and laboratory work. PY 211, mechanics, sound, and heat; PY 212, light and electricity. Staff

PY 221 College Physics 5 (5-0) f s

Prerequisite: MA 111

Required in certain curricula of the School of Agriculture and Life Sciences and the School of Design. An introduction to the origins of physical science, the fundamental principles of physics, and the many applications to modern technology. The important concepts in the classical areas of physics are presented, along with a brief survey of modern atomic physics. Lectures and demonstrations with class participation. Staff

PY 223 Astronomy and Astrophysics 3 (3-0) s

Prerequisite: PY 212 or PY 208

An introduction to descriptive and physical astronomy, with attention to the solar system, constellations, and star groups. The physical aspects of stars, such as brightness, temperature, energy and composition, are reviewed, along with the development of theories of galaxies and the universe. The nature of fusion sources of energies in stars is discussed.

Staff

PY 407 Introduction to Modern Physics 3 (3-0) f s

Prerequisites: PY 208, MA 202

A survey of the important developments in atomic and nuclear physics of this century. Among topics covered are: atomic and molecular structure, determination of properties of ions and fundamental particles, the origin of spectra, ion accelerators, and nuclear reactions. Staff

PY 410 Nuclear Physics I 4 (3-2) f s

Prerequisite: PY 207 or PY 407

An introduction to the properties of the nucleus, and the interaction of radiation with matter. A quantitative description is given of natural and artificial radioactivity, nuclear reactions, fission, fusion, and the structure of simple nuclei. Mr. Waltner

PY 411, 412 MECHANICS 3 (2-3)f s

Prerequisites: PY 207 or PY 208, MA 301

A sequence of courses in intermediate theoretical mechanics, including the dynamics of particles and rigid bodies, gravitation, moving reference systems, and the physics of continuous media. An introduction is given to advanced mechanics, including D'Alembert's Principle and Lagrange's equations of motion, with applications. Mr. Moss

PY 413 THERMODYNAMICS AND KINETIC THEORY 3 (2-2) s

Prerequisites: PY 207 or PY 208, MA 301

An intermediate course in the principles of classical thermodynamics and the kinetic theory of gases with an introduction to statistical mechanics. Topics covered include equations of state, entropy, Maxwellian distributions, transport processes, and the statistics of Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac. Mr. Moss

PY 414, 415 ELECTRICITY AND MAGNETISM 3 (2-2) f s

Prerequisite: PY 207 or PY 208

Corequisite: MA 511

An intermediate course in the fundamentals of static and dynamic electricity and electromagnetic theory, developed from basic experimental laws. Vector methods are introduced and employed throughout the course.
Mr. Katzin

PY 416 OPTICS 3 (2-2) f

Prerequisite: PY 415

An intermediate course in physical and geometrical optics with the major emphasis on the wave properties of light. Mr. Manring

PY 499 SPECIAL PROBLEMS IN PHYSICS 1-3 credits by arrangement

Prerequisite: Permission of department

Study and research in special topics of classical and modern physics. Experimental measurements with emphasis on the treatment and interpretation of data, literature surveys, or theoretical investigations.
Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

PY 501, 502 INTRODUCTION TO QUANTUM MECHANICS I, II 3 (3-0) f s

Prerequisites: MA 511, PY 411 or PY 414

An introduction to quantum mechanics which includes a study of approximation methods, the matrix representation, transformation of representations, and spin angular momentum. Transition and scattering probabilities will be studied and an introduction given to quantum statistics.
Mr. Cobb

PY 503, 504 INTRODUCTION TO THEORETICAL PHYSICS I, II 3 (3-0) f s

Prerequisites: PY 412, PY 414, MA 511, PY 503

An introductory course in theoretical physics which offers preparation for graduate study. Emphasis is on theoretical mechanics, special relativity, the motion of charged particles, and selected topics in electricity and classical field theory. Mr. Moss

PY 507 ADVANCED ATOMIC PHYSICS 3 (3-0) f

Prerequisites: PY 412, PY 415, MA 511

A study of atomic structure and spectra, with emphasis on the analysis of spectra. Topics include: the alkali spectra, multiplet structure, electron spin, hyperfine structure, moments. Mr. Memory

PY 508 PHYSICAL ELECTRONICS 3 (3-0) f

Corequisite: PY 414

Statistical theory of matter, collision phenomena in ionized gases, processes at solid surfaces in vacuum and in ionized gases. Mr. Bennett

PY 509 PLASMA PHYSICS 3 (3-0) s

Prerequisite: PY 508

Individual and collective motion of charged particles in electric and magnetic fields and through ionized gases. Pinch effect, relativistic streams, conductivities, and runaway electrons. Astrophysical concepts and approximations. Properties of plasmas, including waves, confinement, instabilities and shocks, with applications. Mr. Bennett

PY 510 NUCLEAR PHYSICS II 4 credits f

Prerequisite: PY 410

The description and analysis of nuclear energy levels, meson theory, nuclear resonance, atomic and molecular magnetism, and cosmic radiation. Principles and experiments in neutron physics are discussed. In the laboratory work, emphasis is placed on gaining experience in independent research. Mr. Waltner

PY 514, 515 ADVANCED ELECTRICITY AND MAGNETISM 3 (3-0) f s

Prerequisite: PY 415

An advanced treatment of electricity and magnetism and electromagnetic theory. Topics include: techniques for the solution of potential problems; development of Maxwell's equations; wave equations; energy, force, and momentum relations of an electromagnetic field; covariant formulation of electrodynamics; radiation from accelerated charges. Mr. Katzin

PY 517 MOLECULAR SPECTRA 3 (3-0) s

Prerequisites: PY 412; PY 507 recommended

The basic theory will be developed which is required to analyze molecular spectra. Transmission of infrared radiation through atmospheric gases will be discussed, and current molecular band models will be presented. Mr. Patty

PY 518 RADIATION HAZARD AND PROTECTION 3 (3-0) f

Prerequisite: PY 410

Principles of radiation dosimetry and radiation dose units, radiation hazards to man, maximum permissible levels of exposure to external and to internal sources of radiation, methods of providing protection.

Graduate Staff

PY 520 PHYSICAL MEASUREMENTS IN RADIOACTIVITY 3 credits f s

Prerequisite: PY 410

The principles of experimental measurements on radioactive materials are presented and demonstrated through laboratory work. Emphasis is placed on the analytical interpretation of experimental data.

Mr. Lynn

PY 552 INTRODUCTION TO THE STRUCTURE OF SOLIDS 3 (3-0) s

Prerequisite: PY 407

Corequisite: PY 501

Basic considerations of crystalline solids, metals, conductors, and semiconductors. Mr. Memory

PY 555 (See MA 555 PRINCIPLES OF ASTRODYNAMICS) 3 (3-0)

PY 599 Senior Research 3-3

Prerequisite: Senior Honors program standing, except with special permission

Investigations in physics under the guidance of staff members. Literature reviews, experimental measurements, or theoretical studies. A project report is required. Staff

PY 600 Planetary Atmospheres 3 (3-0) s

Prerequisite: PY 507

Current models are developed of the atmospheres of the earth and other planets. The latest ground-based rocket and satellite measurements are described and evaluated. Mr. Manring

PY 601, 602 Theoretical Physics 3 (3-0) f s

Prerequisites: PY 503, PY 514

Corequisite: MA 661

Mathematical and theoretical approach to the relationships between various branches of physics. The restricted theory of relativity, electrodynamics, the theory of electrons, classical field theory, and the general theory of relativity are treated. Mr. Davis

PY 609 High Energy Physics 3 (3-0) s

Prerequisite: PY 510

The experimental and theoretical aspects of nuclear processes at high energy including the classification of mesons and hyperons and their properties, pion-nucleon and nucleon-nucleon interactions, production of mesons and hyperons, strange particles, spallation, fragmentation, and hyperfragments. Mr. Waltner

PY 610 Advanced Nuclear Physics 3 (3-0) s

Prerequisite: PY 510

Corequisite: PY 611

A theoretical study of nuclear structure and reactions. Topics include: the deuteron, low-energy nucleon-nucleon scattering, nuclear forces, nuclear moments, nuclear shell theory, the collective model, the compound nucleus, optical model, and direct reactions. Mr. Park

PY 611 Quantum Mechanics 3 (3-0) f

Prerequisites: PY 502, MA 512

Theory of quantum mechanics with applications to atomic and molecular structure, scattering phenomena, and a semi-classical treatment of the interaction of radiation with matter. Mr. Davis

PY 612 Advanced Quantum Mechanics 3 (3-0) s

Prerequisites: PY 601, PY 611

Dirac's relativistic electron theory, elementary scalar and vector meson field theory. Introduction to quantum electrodynamics and the general theory of quantized fields. Mr. Davis

PY 621 Kinetic Theory of Gases 3 (3-0) f

Prerequisites: PY 501, PY 503, MA 512

The theory of molecular motions, including velocity and density distribution functions; the phenomena of viscosity, heat conduction, and diffusion; equations of state; fluctuations. Mr. Patty

PY 622 Statistical Mechanics 3 (3-0) s

Prerequisites: PY 413, PY 503

Corequisite: PY 611

A treatment of classical and quantum statistical mechanics with some applications to thermodynamics. Topics include: statistics of Maxwell-Boltzmann, Fermi-Dirac, and Bose-Einstein, canonical ensembles and grand canonical ensembles, ideal Fermi gas, ideal Bose gas, imperfect gas, and cooperative phenomena. Mr. Park

PY 641 Non-Inertial Space Mechanics 3 (3-0) s

Prerequisites: PY 601, MA 661

Corequisite: PY 602

The theoretical description of the phenomena of mechanics relating to non-inertial frames of reference with emphasis on applications to space travel and the instrumentation problems of rocketry. Applications to inertial guidance and electro-magnetic-inertial coupling effects are also considered. Mr. Davis

PY 695 Seminar 1 credit f s

Reports on topics of current interest in physics. Several sections are offered so that students with common research interests may be grouped together. Graduate Staff

PY 699 Research credits by arrangement

Graduate students sufficiently prepared may undertake research in some selected field of physics. Staff

PLANT PATHOLOGY

COURSES FOR UNDERGRADUATES

PP 315 Plant Diseases 3 (2-3) f

Prerequisite: BS 100

The nature and symptoms of disease in plants and the characteristics of important plant pathogenic nematodes, viruses, bacteria, and fungi are studied. An understanding of the important concepts and methods of disease control is developed, based on a knowledge of major types of plant diseases. Mr. Powell

PP 318 Diseases of Forest Trees 3 (2-3) s

Prerequisite: BS 100

The nature and symptoms of major types of tree diseases and the important characteristics of their causal agents are studied. Emphasis is placed on the influence of environmental factors on disease development as well as the basic principles and methods of control. Mr. Kelman

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

PP 500 Advanced Plant Pathology 2 (2-0) s

Prerequisite: PP 315 or equivalent

An advanced study of the economic importance, symptoms, disease cycles, epiphytology, and control of major groups of plant diseases. Students who register for this course are also required to register for either PP 501 or PP 502 or they may register for both. Mr. Winstead

PP 501 Advanced Plant Pathology Laboratory—Field Crops Diseases 1 (0-3) s

Prerequisite: PP 315 or equivalent

Laboratory course for students whose major interest is diseases of field crops to accompany lecture course in advanced plant pathology (PP 500). Diseases will be selected for study which are important on field crops. Either this course or PP 502 must be taken concurrently with PP 500.
Mr. Kline

PP 502 Advanced Plant Pathology Laboratory—Horticultural Crop Diseases 1 (0-3) s

Prerequisite: PP 315 or equivalent

Laboratory course for students whose major interest is diseases of horticultural crops to accompany lecture course in advanced plant pathology (PP 500). Diseases will be selected for study which are important on fruit, ornamental and vegetable crops. Either this course or PP 501 must be taken concurrently with PP 500. Mr. Winstead

PP 503 Diagnosis of Plant Diseases 3 (1-4) summer

Prerequisites: One advanced course in Plant Pathology, permission of instructor

A study of techniques used in plant disease diagnosis with emphasis on diagnostic value of signs and symptoms for certain types of diseases. Consideration will be given to major sources of descriptive information on plant pathogens and the use of keys for the identification of fungi.
(Offered in 1964 and alternate years.) Mr. Hebert

COURSES FOR GRADUATES ONLY

PP 601 Phytopathology I 4 (1-6) f

Prerequisites: PP 315, permission of instructor

A study of the principles of phytopathological research. The course is designed to apply the classical scientific method to disease investigation. Exercises will include appraising disease problems, reviewing literature, laboratory and greenhouse experiments, and the evaluation and presentation of data. Mr. Apple

PP 602 Phytopathology II 4 (2-6) s

Prerequisites: PP 315, permission of instructor

The basic concepts of the etiology, pathology, epiphytology, and control of plant diseases. Mr. Nusbaum

PP 604 Plant Parasitic Nematodes 2 (1-3) f

Prerequisite: PP 315

A study of morphology, anatomy, physiology, and taxonomy of plant parasitic nematodes. Methods of isolating nematodes from soil and plant parts and other laboratory techniques used in the study and identification of nematodes will be considered. Mrs. Triantaphyllou

PP 605 Plant Virology 3 (1-6) f

Prerequisites: PP 315, GN 411, and a course in Organic Chemistry

A study of plant viruses including effects of host plants, transmission, classification, methods of purification, determination of properties, chemical nature, structure, and multiplication.
(Offered in 1965-66 and alternate years.) Mr. Hebert

PP 607 (GN 607) GENETICS OF FUNGI 3 (3-0) f

Prerequisites: GN 512 or equivalent, permission of instructor

Review of major contributions in fungus genetics with emphasis on principles and theories that have evolved in recent developments.
(Offered in 1964-65 and alternate years.) Mr. Nelson

PP 608 HISTORY OF PHYTOPATHOLOGY 1 (1-0) f

Prerequisites: PP 315, permission of instructor

Development of the science of phytopathology from its early beginning to the early part of the 20th century.
(Offered in 1965-66 and alternate years.) Mr. Ellis

PP 609 CURRENT PHYTOPATHOLOGICAL RESEARCH UNDER FIELD CONDITIONS 2 (1-3) s

Prerequisite: Graduate standing

Study of concepts involved, procedures used, and evaluation made in current phytopathological research by Plant Pathology staff. Visits to various Research Stations will be made by the class. Mr. Clayton

PP 611 NEMATODE DISEASES OF PLANTS 3 (1-4) s

Prerequisite: PP 604

A study of plant diseases caused by nematodes. Special consideration will be given to host-parasite relationships, host ranges, and life cycles of the more important economic species. Principles and methods of control will be considered. Mr. Sasser

PP 612 PLANT PATHOGENESIS 3 (2-3) f

Prerequisite: PP 500, permission of instructor

A study of interactions of pathogens and suscept plants. The following major topics will be considered: hydrolytic enzyme systems involved in tissue disintegration; role of enzymes, polysaccharides, and toxins in wilting phenomena; mode of action of toxins in altering plant metabolism; role of growth regulators in hypertrophic responses; alterations in respiration and other physiological processes during pathogenesis; and nature and biochemical basis for disease resistance.
(Offered in 1964-65 and alternate years.) Mr. Kelman

PP 690 SEMINAR IN PLANT PATHOLOGY 1 (1-0) f s

Prerequisite: Consent of seminar chairman

Discussion of phytopathological topics selected and assigned by seminar chairman. Graduate Staff

PP 699 RESEARCH IN PLANT PATHOLOGY credits by arrangement

Prerequisites: Graduate standing, consent of instructor

Original research in plant pathology. Graduate Staff

POLITICAL SCIENCE

COURSES FOR UNDERGRADUATES

PS 201 THE AMERICAN GOVERNMENTAL SYSTEM 3 (3-0) f s

PS 202 COUNTY AND MUNICIPAL GOVERNMENT 3 (3-0) f s

PS 301 COMPARATIVE GOVERNMENT: DEMOCRACIES 3 (3-0) f

PS 302 COMPARATIVE GOVERNMENT: TOTALITARIAN STATES 3 (3-0) s

PS 322 Contemporary World Politics 3 (3-0) s

PS 376 Latin American Governments and Politics 3 (3-0) s
(Spring 1966 and alternate years.)

PS 401 American Parties and Pressure Groups 3 (3-0) f

PS 406 Problems in State Government 3 (3-0) s
(Spring 1965 and alternate years.)

PS 431 International Organization 3 (3-0) f
Prerequisite: PS 201 or departmental approval
(Fall 1966 and alternate years.)

PS 442 Government and Planning 3 (3-0) s
Prerequisite: PS 201 or departmental approval
(Spring 1966 and alternate years.)

PS 452 (EPD 452) The Legislative Process 3 (3-0) s
Prerequisite: PS 201 or departmental approval
(Spring 1965 and alternate years.)

PS 481 Political Thought: Plato to the Reformation 3 (3-0) f

PS 485 (EPD 485) American Political Thought 3 (3-0) s
(Spring 1966 and alternate years.)

PS 491, 492 Seminar in Political Science 3 (3-0) f s
Required of seniors majoring or concentrating in Political Science; open to other seniors and graduate students with departmental approval.

PS 496 Governmental Internship and Seminar 6 by arrangement
Prerequisite: Junior standing

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

PS 501 Modern Political Theory 3 (3-0) s

PS 502 (EPD 502) Public Administration 3 (3-0) f s

PS 510 Public Finance (Same as EC 510) 3 (3-0) f
(Spring 1964 and alternate years.)

PS 512 American Constitutional Theory 3 (3-0) f
(Fall 1965 and alternate years.)

COURSES FOR GRADUATES ONLY

PS 691 Applied Principles of Public Administration 2-4 by arrangement
Prerequisite: PS 502 or equivalent

PS 696 Problems in Political Science 2-4 by arrangement
Prerequisite: Advanced graduate standing

POULTRY SCIENCE

COURSES FOR UNDERGRADUATES

PO 201 Poultry Production 4 (3-3) f s
Principles of broiler, market egg, hatching egg and turkey production. Classes, breeds and varieties identification of chickens and turkeys. Breed-

ing, incubation, raising, housing, feeding, disease and parasite control, marketing of chickens, eggs and turkeys. Mr. Brown

PO 301 Poultry Quality Evaluations 2 (1-3) f

Prerequisite: PO 201 or consent of instructor

Evaluation of poultry for production and standard qualities; determining market quality of poultry and eggs. Mr. Brown

PO 351 Poultry Grading 1 (0-3) f

Prerequisite: PO 301

Laboratory experience in determining federal grades of poultry and eggs. Mr. Brown

PO 401 Poultry Diseases 4 (3-3) s

The major infectious, non-infectious and parasitic diseases of poultry are studied with respect to economic importance, etiology, susceptibility, dissemination, symptoms and lesions. Emphasis is placed upon practices necessary for the prevention, control and treatment of each disease. Mr. Craig

PO 402 Commercial Poultry Enterprises 4 (3-2) s

Required of majors in Poultry Science; elective for others with consent of instructor.

Principles of incubation of chicken and turkey eggs; hatchery management; organization and development of plants for the operation and maintenance of a commercial poultry farm for meat and egg production; study of the types of buildings, equipment and methods of management currently employed by successful poultrymen in North Carolina. Problem. Mr. Brown

PO 404 (FS 404) Poultry Products 3 (2-3) f

Prerequisites: BS 100, CH 101

Required of majors in Poultry Science.

Selection, processing, grading, and packaging poultry meat and eggs. Factors involved in preservation of poultry meat and eggs. Mr. Fromm

PO 490 Poultry Seminar 1 (1-0) f s

Current topics and problems relating to Poultry Science and to the poultry industry are assigned for oral report and discussion. Two semesters. Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

PO 520 Poultry Breeding 3 credits f

Prerequisite: GN 411

Application of genetic principles to poultry breeding, considering physical traits and physiological characteristics—feather patterns, egg production, hatchability, growth, body conformation and utility. Mr. Martin

PO 521 Poultry Nutrition 3 (2-3) f

Prerequisite: CH 220 or CH 221

Required of majors in Poultry Science; elective for others with consent of instructor.

A study of proteins, carbohydrates, fats, minerals and vitamins required for growth, egg production and reproduction in the chicken and turkey. Symptoms and lesions induced by nutritional deficiencies. Compounding different types of poultry mashes and methods of feeding these mashes. The production of certain vitamin and mineral deficiencies in chicks for observation and examination. Mr. Kelly

PO 524 (ZO 524) Comparative Endocrinology 3 (2-3) s

Prerequisite: ZO 421 or equivalent

Study of the endocrine system with respect to its physiological importance to metabolism, growth, and reproduction. Mr. Garren

COURSES FOR GRADUATES ONLY

Graduate courses may not be offered if registration for the course is too low or if faculty or facilities become unavailable.

PO 602 Advanced Poultry Nutrition 3 (0-6) arranged

Prerequisites: PO 521, CH 551 or equivalent

Students taking this course will conduct a research problem in poultry nutrition. The problem will involve the designing and carrying out of chick experiments based on biochemical considerations. The students will obtain practice in designing nutritional experiments to obtain insight into biochemical problems. Mr. Hill

PO 698 Special Problems in Poultry Science maximum 6 f s

Prerequisite: Graduate standing

Specific problems of study are assigned in various phases of poultry science. Graduate Staff

PO 699 Poultry Research credits by arrangement f s

Prerequisite: Graduate standing

Appraisal of present research; critical study of some particular problem involving original investigation. Problems in poultry breeding, nutrition, disease endocrinology, hematology or microbiology. Credits: A maximum of six is allowed toward a master's degree. Graduate Staff

PRODUCT DESIGN

COURSES FOR UNDERGRADUATES

PD 201, 202 Product Design and Orientation I, II 4 (3-6) f s

Prerequisite: DN 102

Elementary problems in form and function. Transitional implications of handcrafted and mass-produced objects, in various materials. Demonstrations by specialists in graphics, photography, rendering, modeling, typography, and technical illustration. Visits to design departments of local industries. Mr. Eichenberger

PD 301, 302 Product Design 6 (3-12) f s

Prerequisites: PD 202, PY 212

Manufacturing and structural considerations in the design of a wide range of products. Mr. Baermann

PD 322 Design Graphics and Packaging 3 (0-6) s

Basic disciplines in graphic design, packaging, topography and layout. Mass production of packages, display techniques and market analysis. Mr. Eichenberger

PD 401, 402 Advanced Product Design I, II 6 (3-6) f s

Prerequisite: PD 302

Continuation of Product Design into more complex systems. Emphasis

is placed on functional innovation and integration of form and structure. Thorough analysis of fabrication by models and sketches.
Mr. Eichenberger

PD 422 Office and Industrial Practice 2 (2-0) s
Prerequisite: PD 302
Study of the ethics, organization, and procedures of professional product design practice; patent law. Mr. Baermann

PD 441, 442 Design Analysis 2 (2-0) f s
Prerequisite: PSY 200
Seminar on imaginative problem solving. Individual and group operational techniques in the spectrum of creative thought. Mr. Baermann

PD 501 Advanced Product Design 7 (3-10) f
Prerequisites: PD 402, EM 212
Continuation of emphasis on new product design and development, with reference to current developments in automatic fabrication and assembly.
Mr. Baermann

PD 502 Product Design Thesis 9 (3-12) s
Prerequisites: PD 501, PD 442
A one semester project chosen by the student in his area of major interest, with faculty guidance. Independent research and development of functional contribution, including complete programming of manufacture and distribution systems appropriate to the design. Mr. Baermann

PSYCHOLOGY

COURSES FOR UNDERGRADUATES

PSY 200 Introduction to Psychology 3 (3-0) f s
A study of the general characteristics of human behavior, including motivation, learning, development, motion, thinking, perception and sensation, and measurement. The objectives are: development of the ability to communicate in oral and written form accurately and scientifically about behavior; development of an understanding of and a capacity to use scientific ideas and processes as they apply to behavior; an understanding of the behavior of organisms. Staff

PSY 210 Psychological Analysis Applied to Current Problems 3 (3-0) f s
Prerequisite: PSY 200
This course will seek to develop skill in the analysis and understanding of certain current problems through the use of psychological knowledge and techniques. The problems to be studied will be selected each time the course is offered, from such topics as: the effects of automation, the Negro revolution, international conflict, human development, population control, etc. One of the chief criteria for the selection of topics will be the existence of a substantial scientific psychological literature in the area. Mr. Miller, Staff

PSY 300 Sensation and Perception 3 (2-2) f or s
Prerequisite: PSY 200
An introduction to the anatomy and physiology of the major sensory systems, their relation to central and motor structures, and the elementary facts of sensory psychophysics. An extensive survey of the chief determiners of perception, including stimulus properties, extraneous environmental factors, and organismic variables such as learning and motivation. Laboratory studies of classical problems in perception. Mr. Bernard

PSY 302 Psychology of Personality and Adjustment 3 (3-0) f s

Prerequisite: PSY 200

A study of the factors involved in the development of the normal personality, emphasizing the principal factors controlling human behavior and their relationship to adjustment mechanisms. Mr. Corter

PSY 304 Educational Psychology 3 (3-0) f s

Prerequisite: PSY 200

A study of learning and evaluation in the context of educational practice. Mr. Johnson

PSY 310 Learning and Motivation 3 (2-2) f or s

Prerequisite: PSY 200

The objectives of this course are (1) to acquaint students with the structure of the areas of learning and motivation and with the major theories and empirical findings in these areas; (2) to develop skill in deriving and testing implications of theories and in manipulating theoretical concepts. Messrs. Cook, Newman

PSY 320 Cognitive Processes 3 (2-2) f or s

Prerequisites: PSY 200, PSY 310

This is a course in complex cognitive processes such as: thinking, reasoning, problem solving, creativity and originality, intelligence, social interaction, verbal behavior, and decision processes. It will emphasize theoretical approaches, research findings, and will aim at developing skills in deriving and testing hypotheses in these areas. Messrs. Corter, Leventhal

PSY 337 Industrial Psychology I 3 (3-0) f s

Prerequisite: PSY 200

The application of psychological principles to the problems of industry and business; work methods, fatigue, motivation and morale, job analysis, performance measurement. Mr. Baldwin

COURSES FOR ADVANCED UNDERGRADUATES

PSY 411 Social Psychology 3 (3-0) s

Prerequisite: PSY 200

The individual in relation to social factors. Socialization, personality development, communication, social conflict and social change. Messrs. Barkley, Leventhal, Miller

PSY 438 Industrial Psychology II 3 (3-0) s

Prerequisites: PSY 200, PSY 337

The application of psychological principles to the problems of modern industry, with particular emphasis on human relations and supervision. Mr. Miller

PSY 441 Human Factors in Equipment Design 3 (3-0) s

Prerequisites: PSY 200; PSY 337 recommended

Human factors in the design of machines and other equipment. Items of equipment are understood as extensions of man's capacity to sense, comprehend, and control his environment. Includes problems in the psychology of information, communication, control, and invention. Mr. Baldwin

PSY 464 Visual Perception for Designers 3 (3-0) f

Prerequisite: PSY 200

The nature of the seeing process and its relation to architecture, industrial arts, and to the industrial engineering and textile design fields.

Topics include the basis of sight, perception of color and form, vision and illumination, psychological factors in visual design, and a unit of training planned to improve the student's ability to perceive visual form.

Mr. Bernard

PSY 475 Child Psychology 3 (3-0) s

Prerequisite: PSY 200 or PSY 304

The development of the individual child of the elementary school age will be the inclusive object of study in this course. Emphasis will be placed upon the intellectual, social, emotional, and personality development of the child. Physical growth will be emphasized as necessary to an understanding of the psychological development of the pupil.

Mr. Barkley

PSY 476 Psychology of Adolescence 2 (2-0) f s

Prerequisite: PSY 200

Nature and source of the problems of adolescents in western culture; emotional, social, intellectual and personality development of adolescents.

Mr. Barkley

PSY 491 Seminar in Psychology 3 (0-3) f s

Prerequisite: Senior standing and departmental approval

This course is designed to provide the undergraduate psychology major with: skill in designing and conducting independent research studies; knowledge of sources and skill in locating information pertaining to behavior; knowledge of major trends in selected areas of study; knowledge of the research techniques available to the psychologist; knowledge of the organization of psychology as a profession; and an understanding of the code of ethics for psychologists.

Staff

PSY 492 Seminar in Psychology 3 (0-3) f s

Prerequisite: Senior standing and departmental approval

This course is designed to provide the undergraduate psychology major with: skill in designing and conducting independent research studies; knowledge of sources and skill in locating information pertaining to behavior; knowledge of major trends in selected areas of study; knowledge of the research techniques available to the psychologist; knowledge of the organization of psychology as a profession; and an understanding of the code of ethics for psychologists.

Staff

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

PSY 501 Experimental Psychology 3 (2-3) f s

Prerequisite: Nine hours in Psychology

Experimental study of problems in general and theoretical psychology with particular emphasis on sensation and perception. Particular attention is paid to problem formulation, experimental design and experimental method. Effective written and oral performance by the student is a basic objective.

Messrs. Barkley, Cook, Newman

PSY 502 Physiological Psychology 3 (3-0) f

Prerequisites: Twelve hours in Psychology, including PSY 200

A survey of the physiological bases of behavior including the study of coordination, sensory processes, brain functions, emotions, and motivation.

Mr. Bernard

PSY 504 Advanced Educational Psychology 3 (3-0) s

Prerequisites: Six hours in Psychology

A critical appraisal of current psychological findings that are relevant to educational practice and theory.

Mr. Johnson

PSY 511 Advanced Social Psychology 3 (3-0) f

Prerequisites: Nine hours in Psychology

A study of social relationships and their psychological bases; emphasis on those aspects of behavior determined by personal interactions; work will involve analysis of representative research studies, and individual projects. Mr. Miller

PSY 514 Psychological Research Design 1 (1-0) f

Prerequisite: Graduate standing in Psychology

The objectives of this course are to acquaint students with current developments in theory and research in several areas of psychological interest; to foster capability to derive experimentally testable hypotheses, and experimental tests of these hypotheses; to write and speak effectively about theory and experimentation in psychology.

Graduate Staff

PSY 530 Abnormal Psychology 3 (3-0) s

Prerequisites: PSY 200, PSY 302

A study of the causes, symptomatic behavior, and treatment of the major personality disturbances; emphasis also placed on preventive mental hygiene methods. Mr. Corter

PSY 535 Tests and Measurements 3 (3-0) f s

Prerequisite: Six hours in Psychology

A study of standard tests with an emphasis on the efficient selection and use of such instruments. Mr. Johnson

PSY 540 Human Factors 3 (3-0) f

Prerequisite: Six hours in Psychology

An introduction to how the methods and techniques of experimental psychology can be applied to the problems of designing equipment for human use. The areas of information processing, decision making, motor capacities, and research techniques will be emphasized. Mr. Baldwin

PSY 550 Mental Hygiene in Teaching 3 (3-0) f

Prerequisite: Six hours in Psychology

A survey of mental hygiene principles applicable to teachers and pupils; practical problems in prevention and treatment of psychological problems in school; case studies and research.

Messrs. Barkley, Corter

PSY 565 Industrial Management Psychology 3 (3-0) s

Prerequisites: Nine hours in Psychology

A study of the application of behavioral science; particularly psychology and social psychology to organizational and management problems.

Mr. Miller

PSY 570 Theories of Personality 3 (3-0) s

Prerequisite: Nine hours in Psychology

A survey of modern theories of personality with some emphasis on intelligence and cognitive factors. Mr. Corter

PSY 576 Developmental Psychology 3 (3-0) s

Prerequisite: Nine hours in Psychology, including PSY 476 or PSY 475

A survey of the role of growth and development in human behavior; particularly of the child and adolescent periods. This course will pay particular attention to basic principles and theories in the area of developmental psychology. Mr. Johnson

PSY 578 INDIVIDUAL DIFFERENCES 3 (3-0) f

Prerequisite: Six hours in Psychology

Nature, extent, and practical implications of individual differences and individual variation. Mr. Barkley

PSY 591 INDIVIDUAL INTELLIGENCE MEASUREMENT 3 (3-0) f

Prerequisite: PSY 570

A practicum in individual intelligence testing with emphasis on the Wechsler-Bellevue, Stanford-Binet, report writing, and case studies.

Mr. Corter

COURSES FOR GRADUATES ONLY

PSY 604 ADVANCED EXPERIMENTAL PSYCHOLOGY: LEARNING AND MOTIVATION 3 (2-3) s

Prerequisite: PSY 501 or equivalent

The objectives of this course are to promote familiarity with the kinds of research currently being conducted within the areas of "learning and motivation"; to foster effective performance in writing, speaking and reading in this area, in the derivation of hypotheses capable of experimental test and in design of experiments to test them.

Messrs. Cook, Newman

PSY 606 BEHAVIOR THEORY 3 (3-0) s

Prerequisite: PSY 200, a course in learning, Experimental Psychology and Statistics

A study of the most fundamental considerations in behavior theory. Such topics as criteria of scientific meaningfulness, the nature of scientific explanation, the application of formal, logical techniques to theory analysis, the nature of probability, operationism, intervening variables, etc., will be covered. The aim of the course is to develop skill in handling theoretical concepts, the ability to analyze and evaluate theories, to deduce hypotheses from them, and to devise means of testing them.

Mr. Cook

PSY 607 ADVANCED INDUSTRIAL PSYCHOLOGY I 3 (3-0) f

Prerequisite: Nine hours in Psychology and Statistics or concurrent with Statistics

Application of scientific methods to the measurement and understanding of industrial behavior. Messrs. Baldwin, Drewes, Miller

PSY 608 ADVANCED INDUSTRIAL PSYCHOLOGY II 3 (3-0) s

Prerequisite: PSY 607

Application of scientific methods to the measurement and understanding of industrial behavior.

Messrs. Baldwin, Drewes, Miller

PSY 610 THEORIES OF LEARNING 3 (3-0) f or s

Prerequisite: PSY 604

The objectives of this course are to promote learning of the theories currently used to explain how learning and forgetting occur so that testable consequences of these theories can be derived and so that the theories and their testable consequences are capably written and spoken about.

Messrs. Cook, Newman

PSY 635 PSYCHOLOGICAL MEASUREMENT 3 (3-0) f

Prerequisites: ST 511 or equivalent, 12 hours in Psychology

Theory of psychological measurement. Statistical problems and techniques in test construction. Mr. Drewes

PSY 640 Advanced Human Factors 3 credits s

Prerequisites: Twelve hours in Psychology, including PSY 540, MA 421; Statistics, or may be taken concurrent with Statistics

This course is designed to provide the student with (1) an understanding of the major areas of experimental and theoretical work being done in the field of human factors engineering and (2) experience in applying the large body of knowledge available in this field to the design of man-machine systems. Mr. Baldwin

PSY 690 Seminar in Industrial Psychology 3 (3-0) f s

Scientific articles, analysis of experimental designs in industrial psychology, and study of special problems of interest to graduate students in Industrial Psychology. Graduate Staff

PSY 692 Personality Measurement 3 (2-3)

Prerequisites: PSY 570, PSY 591

Theory and practicum in individual personality testing of children and adults with emphasis on projective techniques, other personality measures, report writing and case studies. Mr. Corter

PSY 693 Psychological Clinic Practicum maximum 12 f s

Prerequisite: Eight hours in Psychology

Clinical participation in interviewing, counseling, psychotherapy, and administration of psychological tests. Practicum to be concerned with adults and children. Mr. Corter

PSY 699 Research in Psychology credits by arrangement

Individual or group research problems; a maximum of six credits is allowed toward the Master's degree. Graduate Staff

RECREATION AND PARK ADMINISTRATION

COURSES FOR UNDERGRADUATES

RPA 152 Introduction to Recreation 3 (3-0) f s

This course is designed to provide instruction in the areas of history and foundations of recreation including objectives, economic and social aspects, definition and importance; status of organized recreation in our modern society; certain applied principles of recreation; recreation leadership; activities and program planning; and tournament planning and administration. The course is of lecture-laboratory technique.

Mr. Hines

RPA 153 The Aquatic Program 2 (2-0) f s

Prerequisite: PE (swimming)

This is a laboratory course including the history of the techniques and methods of teaching swimming, modern methods of teaching diving, officiating, games, pageants, the use of small craft, life-saving techniques, principles of water safety, the organization and administration of water safety programs and the maintenance of the swimming pool and water front.

Mr. Stott

RPA 201 Playground Leadership 3 (2-3) f s

Prerequisite: RPA 152

Emphasis is placed on the principles, techniques, and activities necessary for effective playground leadership. Special emphasis is given through the following practical laboratory experiences: activities of low organization;

contests; relays; aquatic activities; table games; and elementary arts and crafts.
Mr. Miller

RPA 207 History and Principles of Park Administration 2 (2-0) f s
Prerequisite: RPA 152

This course includes the study of the history, present status and the basic principles of operation of parks and park systems in America.
Mr. Miller

RPA 253 Principles of Physical Education 3 (3-0) f s

This course is designed to give the student a professional orientation in physical education and the place of physical education activities in allied and related fields. It introduces the student to the program of physical education—its interpretation in the light of present day needs, its sociological basis, aims and objectives and a sampling of program activities.
Mr. Brantley

RPA 255 Social Recreation 4 (2-4) f s
Prerequisite: Sophomore status

This course is designed to satisfy the needs of the recreator for conducting social play. Stress is placed on the acquiring of technical knowledge of social activities including rhythmics and square dancing, and the conducting of specific types of activities.
Mr. Crawford

RPA 301 Organization and Administration of Physical Education 3 (3-0) f s
Prerequisite: RPA 253

This course is designed to prepare students to meet the problems of organization and administration of physical education. It presents the solution to many of the problems facing the administrator and teacher in organizing and administering a physical education program with analogies of these problems to other areas in the field of recreation.
Mr. Brantley

RPA 315 Prevention and Care of Athletic Injuries 2 (2-0) f s
Prerequisite: ZO 213

This course is designed for students in residence and for individuals in service, directors of community centers, boys clubs, coaches of athletic teams, athletic directors and others who are confronted constantly with prevention and the care of athletic injuries. The course is of lecture-laboratory techniques.
Mr. Crawford

RPA 333 First Aid and Safety 2 (1-2) f s

This course stresses first aid and safety education in relation to the home, school and community. It strongly emphasizes safety principles as applied to activities of the gymnasium, playgrounds and athletic fields. Laboratory will provide practice in first aid skill.
Mr. Crawford

RPA 335 Camping and Outdoor Education 3 (2-2) f s
Prerequisite: Junior status

This course covers the history of school camping and outdoor education. The scope of this course is to provide the student with a background of principles, organization and administrative techniques, and camping skills to be utilized in a school operated program.
Mr. Stott

RPA 353 Camp Organization and Leadership 3 (2-2) f s
Prerequisites: RPA 152, RPA 201

This course surveys the development of organized camping and the edu-

cational, health, and recreational objectives of camping. Program planning and leadership training in community, private, agency and school camping is emphasized. Laboratory will provide practice in campcraft skills.
Mr. Stott

RPA 354 Personal and Community Hygiene 3 (3-0) f s
Prerequisite: Junior status

This course presents the essential present-day knowledge of personal and community health. Emphasis is placed upon health problems, disease prevention, communicable diseases and their control, public health administration, school and industrial hygiene and various other health problems confronting the individual and community. The course presents valuable and interesting health information to college men and women in order that they might live more intelligently in terms of newer health concepts and also be better prepared to assume their responsibilities as citizens of their respective communities. Mr. Miller

RPA 355 Sports in Recreation 4 (2-4) f s
Prerequisite: RPA 152

This course provides for group instruction and laboratory experience in a variety of sports applicable to a recreation setting. Emphasis is given to problems involved in the organization and administration of a commmunity sports program. Officiating techniques applicable to recreation sports are utilized. Mr. Brantley

RPA 360 Individual Corrective and Adapted Activities 3 (3-0) f s
Prerequisites: ZO 212, ZO 213

This course provides students with: methods to motivate the atypical individual to not only his physical condition but also to his outlook on life; to utilize modern educational principles and sport activities which will satisfy the handicapped individual's needs, interest, and capacity.
Mr. Crawford

RPA 365 Methods and Materials in Health and Physical Education 3 (3-0) f s
Prerequisite: RPA 301

This course presents to the prospective physical activity instructor methods and materials of instruction; also the course provides study in the areas of healthful school living, health service, and health instruction.
Mr. Brantley

COURSES FOR ADVANCED UNDERGRADUATES

RPA 405 Management of Revenue Sources for Public Recreation 3 (3-0) f s
Prerequisite: RPA 415

A study of existing practices of recreation—their operation, methods of finance, scope, and problems are emphasized. The inter-relationship and inter-dependence of all forms of organized recreation are stressed.
Mr. Hines

RPA 415 Park Maintenance and Operation 3 (3-0) f s
Prerequisite: RPA 152

This course deals with methods of operation of various park facilities for public use; interpretive and public use programs; information and education; park personnel administration; protection and law enforcement; preventive maintenance; job planning and scheduling; modern maintenance techniques and maintenance materials. Mr. Stott

RPA 451 Facility and Site Planning 3 (0-6) f s

Prerequisite: RPA 415

This course includes the history of park and recreation facility development and trends in recreation facility planning. Emphasis is placed upon the planning principles involved in the design and layout of recreation areas and recreation buildings. Field trips will enable the student to see the various types of recreation facilities. Mr. Stott

RPA 452 Recreation Administration 3 (3-0) f s

Prerequisite: Senior status

This course deals with the internal organization of a recreation department; financing; accounting and financial procedures; budget making and control; records, reports and filing; program planning and control; personnel policies and organization; and public relations.

Mr. Hines

RPA 470 Supervised Practice 6 (9 weeks) summer

Prerequisites: RPA 353, RPA 355 or equivalent

This course is intended to provide the prospective recreation director with an opportunity to acquire experience in the skills and techniques involved in the organization and administration of recreation activities in an established program. Each student prior to his senior year will spend 9 weeks off-campus in a selected location. (A minimum of 225 contact hours are required.) The student will have the opportunity to observe the activities and practices of the recreation executive, to organize and conduct activities under supervision, to observe activities and practices of experienced recreation activity leaders and to observe the maintenance and operation of facilities. Mr. Miller

RPA 471 Organizing the Recreation Program 2 (2-0) f s

Prerequisite: Senior status

This course includes the types of recreation opportunities to be made available to individuals, groups or communities to be served and the methods of providing these opportunities. Activities to be considered are classified as arts and crafts; dance; drama; games, sports and athletics; hobbies; music; outdoor recreation; reading, writing and speaking; social recreation; special events and voluntary service. The lecture-discussion technique is used. Outside studies and assigned readings with reports are required. Mr. Miller

RPA 472 Observation and Field Experience 2 (0-6) f s

Prerequisite: Senior status

This course is designed to provide the student with the opportunity to observe, appraise and evaluate: the operation of program activities; teaching methods; administrative, supervisory and organizational techniques; procedures and conduct of advisory and commission meetings; professional conferences and society meetings. Students will be expected to complete this entire gamut. By use of field experience the student will be expected to prepare written reports of observations. Only those experiences approved by the recreation faculty shall be accepted. Mr. Miller

RPA 480 Student Teaching in Physical Education 6 (2-15) s

Prerequisites: ED 344, PSY 304, RPA 365

This course is intended to provide the prospective teacher with the opportunity to acquire experience in the skills and techniques involved in the teaching of physical activities. Each student during the senior year will spend 10 weeks off-campus in a secondary school. In addition, the student teacher will have an opportunity to become familiar with the total school program. Mr. Brantley

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

RPA 591 Special Problems in Recreation 3 (2-2) f s

Prerequisite: Senior status

A survey of specific problems in recreation. Aims to develop critical analysis. Forms a basis for the organization of research projects, for the compilation and organization of material in a functional relationship and for the foundation of policies. Follows the seminar procedure.

Mr. Hines

RURAL SOCIOLOGY

* COURSES FOR UNDERGRADUATES

RS 204 North Carolina and the Changing South 2 (2-0) f s

This course is designed to give students an understanding of the dynamic nature of North Carolina. The state is placed in perspective with respect to the southern region and its place in the nation. Considerable emphasis is given to the changes which are taking place including the nature, diversity, and intensity of these changes. Similarly, the changes are placed in historical perspective in terms of cultural continuity. Students will investigate the major social movements under way in the state and region with respect to the goals of and the tactics employed in these social movements.

RS 301 Sociology of Rural Life 3 (3-0) f s

Prerequisite: Completion of the freshman year

A systematic sociological analysis of the characteristics, institutions and problems of rural life. Part I is a brief description of the basic concepts, the theoretical framework and the method of analysis of institutions and problems. Part II consists of systematic analysis of the major social institutions and their respective problems. Part III portrays the role of the community as an area of institutional functioning and societal integration.

RS 321 Introduction to Social Research 3 (3-0) f s

Prerequisite: RS 301 or equivalent

Designed to give the student a basic understanding of the methods of sociological research. Reviews the scientific method and its application to the design of social research including the collection, analysis, and interpretation of social data. Appropriate ways of presenting the findings and of making the greatest use of the data are presented. Critical and objective thinking are stressed throughout the course.

RS 322 Introduction to Rural Social Work 3 (3-0) s

Prerequisite: RS 301 or permission of instructor

Constructed to acquaint the preprofessional student with the subject matter of social work as well as its related professional fields. Attention is given to three major areas: (1) case work in various settings, (2) group work, and (3) community organization. Public and private agencies which employ persons trained in social work are studied.

RS 418 (SOC 418, ED 418) Educational Sociology 3 (3-0) f s

Prerequisite: Three hours of Sociology

An investigation of the educational institution in a sociological frame-

* Additional courses, suitable for rural sociology majors and graduate students, are listed in the offering of the Department of Sociology and Anthropology. Other sociology courses especially suited for advanced students and graduates are offered by the Department of Sociology and Anthropology at the University at Chapel Hill.

work. Analyzes the school as a social system, roles of the functionaries of education, relationships within the student body, effects of social factors upon the learning experience, reciprocal school-community relationships, adult education, and higher education in American society.

RS 441 Rural Social Pathology 3 (3-0) f

Prerequisites: RS 301 or permission of instructor

A study of major social problems in modern society: physical and mental health, family instability, crime and penology, and minority group problems. A framework for analysis and understanding is presented and stressed throughout, including a positive approach for prevention.

RS 442 Rural Social Structure 3 (3-0) s

Prerequisite: RS 301 or permission of instructor

Social structure is viewed in its two major dimensions: (1) vertically through the concepts of social stratification; and (2) horizontally as a set of basic social institutions interacting by means of a system of concrete social organizations. Particular attention is given to the place of the rural segment in the total social system. The bases of social cohesion which permit diversity within a functioning whole are examined.

*COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

RS 511 Rural Population Problems 3 (3-0) f

Prerequisite: RS 301 or equivalent

A study of population growth, rates of change and distribution. Considerable attention is given to the functional roles of population, i.e., age, sex, race, residence, occupation, marital status and education. The dynamic aspects of population are stressed: fertility, mortality and migration. Population policy is analyzed in relation to national and international goals. A world view is stressed throughout.

RS 512 Rural Family Living 3 (3-0) s

Prerequisite: RS 301 or equivalent

Values, patterns and levels of rural family living. Differentials and factors related thereto in the world, the nation and North Carolina. Analysis of selection problems, programs, policies and methods of study.

RS 513 Community Organization 3 (3-0) f

Prerequisite: RS 301 or equivalent

Community organization is viewed as a process of bringing about desirable changes in community life. Community needs and resources available to meet these needs are studied. Democratic processes in community action and principles of community organization are stressed along with techniques and procedures. The roles of leaders, both lay and professional, in community development are analyzed.

RS 523 Sociological Analysis of Agricultural Land Tenure Systems 3 (3-0) f

Prerequisite: Three hours of Sociology

A systematic sociological analysis of the major agricultural land tenure systems of the world with major emphasis on the problems of family farm ownership and tenancy in the United States.

RS 534 (HI 534) Agricultural Organizations and Movements 3 (3-0) s

Prerequisite: Three hours of Sociology

A history of agricultural organizations and movements in the United

* See footnote on preceding page.

States and Canada, principally since 1865, emphasizing the Grange, the Farmers' Alliance, the Populist Revolt, the Farmers' Union, the Farm Bureau, the Equity socities, the Non-Partisan League, cooperative marketing, government programs and present problems.

RS 541 Social Systems and Planned Change 3 (3-0) s

Prerequisite: Three hours of Sociology

Study of social agencies and programs and their implementation through specific organizations in dynamic relation with the people whom they serve. Consideration is given to the relation of these agencies and programs to community structure and forces in rural society; coordination of the several types of agencies and programs; professional leadership in the local community; and problems of stimulating local leadership and participation.

COURSES FOR GRADUATES ONLY

RS 611 Research Methods in Sociology 3 (3-0) f

Prerequisite: Six hours of Sociology

Designed to give the student a mature insight into the nature of scientific research in sociology. Assesses the nature and purpose of research designs, the interrelationship of theory and research, the use of selected techniques and their relation to research designs, and the use of modern tabulation equipment in research.

RS 621 Rural Social Psychology 3 (3-0) f

Prerequisite: Six hours of Sociology

Treats the genetic development of the rural personality and the interrelationship of the individual and the rural society. Studies the social psychological factors related to rural leadership, morale, social organization and social change, and examines the attitudes and opinions of rural people on current local and national issues.

RS 631 Population Analysis 3 (3-0) s

Prerequisite: Six hours of Sociology

Methods of describing, analyzing and presenting data on human populations: distribution, characteristics, natural increase, migration and trends in relation to resources.

RS 632 Rural Family 3 (3-0) f

Prerequisite: Six hours of Sociology

Emphasis is placed on the development of an adequate sociological frame of reference for family analysis; on discovering both the uniquely-cultural and common-human aspects of the family by means of cross-cultural comparisons; on historical explanations for variability in American families with special concern for the rural family; and on analyzing patterns of family stability and effectiveness.

RS 633 The Rural Community 3 (3-0) s

Prerequisite: Six hours of Sociology

The rural community is viewed in sociological perspective as a functional entity. A method of analysis is presented and applied to eight "dimensions," with emphasis on the unique types of understanding to be derived from measuring each dimension. Finally, the effect of change on community integration and development is analyzed.

RS 641 Statistics in Sociology 3 (3-0) s

Prerequisite: ST 513

The application of statistical methods in sociological research. Emphasis on selecting appropriate models, instruments and techniques for the more frequently encountered problems and forms of data.

RS 653 THEORY AND DEVELOPMENT OF RURAL SOCIOLOGY 3 (3-0) s

Prerequisite: Six hours of Sociology

Required of all master's and doctoral candidates in Rural Sociology and recommended for all graduate minors. Designed to meet two objectives: (1) to introduce the student to the study of current sociological theory, and (2) to survey events and trends in historical development of rural sociology.

RS 690 SEMINAR credits by arrangement

Appraisal of current literature; presentation of research papers by students; progress reports on departmental research; review of developing research methods and plans; reports from scientific meetings and conferences; other professional matters. (A maximum of two credits is allowed toward the master's degree, and four credits toward the doctorate.)

RS 699 RESEARCH IN RURAL SOCIOLOGY credits by arrangement (maximum 6)

Prerequisite: Permission of chairman of graduate study committee

Planning and execution of research, and preparation of manuscript under supervision of graduate committee.

SOCIAL STUDIES

SS 301, 302 SCIENCE AND CIVILIZATION 3 (3-0) f s

Prerequisites: For engineering students, ENG 205, HI 205, EC 205; for others, permission of the department

An examination of the major concepts, methods and values that characterize modern thought in the fields of physical science, the humanities and the social sciences. The course utilizes the student's previous training, plus materials from the history and philosophy of science and the history of technology to demonstrate the essential interrelatedness of scientific, social, and aesthetic activity.

SS 491, 492 CONTEMPORARY ISSUES 3 (3-0) f s

Prerequisites: For engineering students, SS 301, SS 302; for others, permission of the department

This course deals with concrete problems as they arise from day to day in the world of public affairs. These problems are studied and discussed in the context of a search for a more realistic definition of the limits of freedom and authority. Text materials are books, magazines and newspapers.

SOCIOLOGY

(Also see Anthropology)

COURSES FOR UNDERGRADUATES

SOC 202 PRINCIPLES OF SOCIOLOGY 3 (3-0) f s

Introduction to the scientific study of man's behavior in relation to other men, the general laws affecting the organization of such relationships and the effects of social life on human personality and behavior.

SOC 301 HUMAN BEHAVIOR 3 (3-0) f s

A study of the effects of social interaction upon individual behavior and personality; collective attitudes and behavior as products of group experience; analysis of fashions and fads, crowds, mobs, publics, social movements.

SOC 302 PUBLIC RELATIONS AND MODERN SOCIETY 3 (3-0) f s

The development and composition of social groups and the processes involved in group organization. These are analyzed in terms of the expanding functions of mass communication in contemporary society.

SOC 303 CURRENT SOCIAL PROBLEMS 3 (3-0) f s

Study of the social and cultural aspects of specific problems such as crime, divorce, race conflict, illness, poverty, housing, recreation and personality adjustment to demonstrate the basic integration of society and community life.

SOC 304 CONTEMPORARY FAMILY LIFE 3 (3-0) f s

The social organization of the family with special attention to socialization, marital choice, kinship relations, and the social changes affecting family structure and functions.

SOC 305 RACE RELATIONS 3 (3-0) f s

Analysis of race relationships both in the United States and throughout the world with particular emphasis on factors producing the changes taking place at the present time.

SOC 306 CRIMINOLOGY 3 (3-0) f s

The study of causation, treatment, prevention, and control of criminality and juvenile delinquency. Special emphasis is placed on sociocultural theories of causation and on the examination of court and correctional systems for adults and juveniles. Arranged field trips.

SOC 315 SOCIAL THOUGHT 3 (3-0) f s

Prerequisite: SOC 202 or equivalent

The development of social thought from lore to science; historical changes in explanatory systems of human behavior; theories of the individual, group, culture, community, and society; the emergence of sociological systems of analysis; the role of the sociologist in the study of social phenomena including planned change.

SOC 401 HUMAN RELATIONS IN INDUSTRIAL SOCIETY 3 (3-0) f s

Prerequisites: Senior standing and permission of instructor

Studies in the sociology of occupations, professions and work, with special attention to human relations in industrial plants and other work situations.

SOC 402 URBAN SOCIOLOGY 3 (3-0) f s

Prerequisites: SOC 202 and permission of instructor

A study of the factors in the growth of cities; the relationship between the design of cities and their social organization; detailed analysis of new developments in the serving of human needs. City and regional planning.

SOC 411 COMMUNITY RELATIONSHIPS 3 (3-0) f s

Prerequisites: SOC 202 and permission of instructor

A survey of the institutions, organizations, and agencies found in modern communities; social problems and conditions with which they deal; their interrelationship and the trend toward over-all planning.

SOC 412 INTRODUCTION TO SOCIAL WORK 3 (3-0) f s

Prerequisites: SOC 202 and permission of instructor

A course designed to acquaint students with the various types of public and private social work and with remedial and preventive programs in applied sociology, social psychiatry, health, public welfare, and recreation.

SOC 414 SOCIAL STRUCTURE 3 (3-0) f s

Prerequisites: Six hours in Sociology and permission of instructor

Studies of the major social institutions and systems of stratification; the organization of social studies of the major social institutions and systems of stratification; the organization of social systems as, for example, religion, education, and government; the functions of such structural components as age and sex groups, vocational and professional groups, and social classes.

SOC 416 RESEARCH METHODS 3 (3-0) f s

Prerequisites: Nine hours in Sociology and permission of instructor

An analysis of the principle methods of social reesearch; the development of experiments; schedules and questionnaires; the measurement of behavior.

SOC 418 EDUCATIONAL SOCIOLOGY 3 (3-0) f s

Prerequisite: Three hours of Sociology

An investigation of the educational institution in a sociological framework. Analyzes the school as a social system, roles of the functionaires of education, relationships within the student body, effects of social factors upon the learning experience, reciprocal school-community relationships, adult education, and higher education in American society.

SOC 490, 491 SENIOR SEMINAR 3 (3-0) f s

Prerequisite: Permission of department

This course is of an integrative nature giving the student an opportunity to synthesize knowledge, theory and methods learned in earlier courses and to conduct original explorations in areas of special interest.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

SOC 501 LEADERSHIP 3 (3-0) f s

Prerequisites: SOC 202, SOC 301 or equivalent

A study of leadership in various fields of American life; analysis of the various factors associated with leadership, with particular attention given to recreational, scientific and executive leadership problems.

SOC 502 SOCIETY, CULTURE, AND PERSONALITY 3 (3-0) f s

Prerequisites: SOC 202, SOC 301 or equivalent

Human personality from its origins in primary groups through its development in secondary contacts and its ultimate integration with social norms. Emphasis is placed upon the normal personality and the adjustment of the individual to our society and our culture. Dynamics of personality and character structure are analyzed in terms of the general culture patterns and social institutions of society.

SOC 505 THE SOCIOLOGY OF REHABILITATION 3 (3-0) f s

Prerequisites: SOC 202, SOC 301 or equivalent

The course stresses the social and cultural implications of the rehabilitation approach. Emphasis is placed upon the social and personal problems of physically and mentally handicapped persons. The interrelationships of the major social environments are considered at length in this regard. Objec-

tives of the rehabilitation processes are analyzed in terms of the sociology of work. A major portion of the course is devoted to rehabilitation as a profession, particular attention being given to the diverse roles of specialists in this field.

SOC 510 Industrial Sociology 3 (3-0) f s

Prerequisites: SOC 202, SOC 301 or equivalent

Industrial relations analyzed as group behavior with a complex and dynamic network of rights, obligations and rules; the social system as an interdependent part of total community life; background and functioning of industrialization studied as social and cultural phenomena; analysis of specific problems of industry.

SOC 511 Sociological Theory 3 (3-0) f s

Prerequisites: Six semester hours in Sociology and graduate standing or permission of instructor

Study of the interdependence of theory and method; the major theoretical and methodological system; and examination of selected cases of research in which theory and method are classically combined.

SOC 590 Applied Research 3 (3-0) f s

Prerequisites: SOC 202, SOC 301 or equivalent

Individual research problems in applied fields of sociology, such as problems of the family, population and social work; rural-urban relations; student success; American leadership.

SOIL SCIENCE

COURSES FOR UNDERGRADUATES

SSC 200 Soils 4 (3-3) f s

Prerequisite: CH 103 or CH 107; MIG 120 recommended but not required

Fundamentals of soil science: origin, composition and classification of soils; their physical, chemical, and biological properties; significance of these properties to soil-plant relationships and soil management.

Mr. Cook

SSC 302 Soils and Plant Growth 4 (3-3) s

Prerequisites: SSC 200, BS 100

An examination of the fundamental chemical, physical and microbiological characteristics of soils, as related to crop production. The chemical and mineralogical composition of soils; ion exchange, soil reaction and the solubilities of plant nutrients; transformations between organic and inorganic forms of plant nutrients; water and air relations in soils; lecture-demonstrations will be used to illustrate fundamental soil properties and to acquaint students with methods used in the study of soils.

Mr. Cummings

SSC 341 Soil Fertility and Fertilizers 3 (3-0) f

Prerequisites: SSC 200, BS 100

History of plant nutrition and soil fertility. Plant nutrition and growth as related to crop fertilization. Fertilizer materials, their manufacture, properties and usage. Fertilizer practices as related to a sound soil management program. Mr. Kamprath

SSC 452 Soil Classification 3 (2-3) s

Prerequisite: SSC 200

Presentation of factors involved in the genesis, morphology and classification of soils, emphasis upon soil profile properties as operational criteria in the modern classification system; practical field problem in recognition and evaluation of soil profile properties.

Mr. Cook

SSC 461 Soil Conservation and Management 3 (3-0) f

Prerequisite: SSC 200 or equivalent

The history and status of erosion and fertility conditions; the economic and social aspects of soil conservation; the effects of climatic factors, vegetation (forest, sod crops, cover crops and soil rotations), soil properties, and other management practices on soil conservation and fertility maintenance. Mr. Lutz

SSC 472 Forest Soils 3 (2-3) s

Prerequisites: SSC 200, SSC 341 or FOR 361 or equivalent

Soil as a medium for tree growth; the relation of soil physical, chemical, and biological factors to the practice of silviculture; extensive soil management in the forest and intensive soil management in forest nurseries and in seed-tree orchards; the relation of soil and site to current work in genetics, ecology, pathology and entomology. Mr. Davey

SSC 492 Senior Seminar 1 (1-0) s

Prerequisite: Senior standing in the School of Agriculture and Life Sciences

A student participation course in which the student will prepare and present thorough and documented discussions of important soil topics.

Staff

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

SSC 511 Soil Physics 4 (3-3) f

Prerequisites: SSC 200, PY 212

Physical constitution and analyses; soil structure, soil water, soil air and soil temperature in relation to plant growth.

Mr. Lutz

SSC 522 Soil Chemistry 4 (3-3) s

Prerequisites: SSC 200, SSC 553, CH 433 or equivalents

A consideration of the chemical and colloidal properties of clay and soil systems, including ion exchange and retention, soil solution reactions, solvation of clays, and electrokinetic properties of clay-water systems.

Mr. Weed

SSC 524 Mass Spectrometry 2 credits s

Prerequisites: SSC 302, CH 433 or permission of instructor

An examination of theoretical and analytical aspects of mass spectrometry and stable isotopic techniques; application of these methods to biochemical research. Mr. Volk

SSC 532 Soil Microbiology 3 (3-0) s

Prerequisites: SSC 302 or SSC 341, BO 412, CH 220

The more important microbiological processes that occur in soils; decomposition of organic materials, ammonification, nitrification, and nitrogen fixation. Mr. Bartholomew

SSC 541 Soil Fertility 3 (3-0) f

Prerequisites: SSC 302, SSC 341

Soil conditions affecting plant growth and the chemistry of soil and fertilizer interrelationships. Factors affecting the availability of nutrients. Methods for measuring nutrient availability.

Mr. Kamprath

SSC 551 Soil Morphology, Genesis and Classification 3 (3-0) f

Prerequisites: SSC 200, SSC 302 or SSC 341, MIG 120

Morphology: study of concepts of soil horizons and soil profiles and chemical, physical and mineralogical parameters useful in characterizing them. Genesis: critical study of soil forming factors and processes. Classification: critical evaluation of historical development and present concepts of soil taxonomy with particular reference to great soil groups as well as discussion of logical basis of soil classification.

Mr. McCracken

SSC 553 Soil Mineralogy 3 (2-3) f

Prerequisites: SSC 200, SSC 341, MIG 331 or equivalents

Composition, structure, classification, identification, origin, occurrence, and significance of soil minerals with emphasis on primary weatherable silicates, layer silicate clays, and sesquioxides.

Messrs. Cook, Weed

SSC 560 North Carolina Soils and Their Management 3 summer

Prerequisites: SSC 200, SSC 302, or SSC 341

Field studies of selected soil series in the Coastal Plain, Piedmont and Mountain areas of North Carolina. Discussion of management practices that should be associated with the various soils under different types of farming. Messrs. McCracken, Spain, and Staff

SSC 590 Special Problems credits by arrangement

Prerequisites: SSC 200, SSC 302

Special problems in various phases of soils. Problems may be selected or will be assigned. Emphasis will be placed on review of recent and current research. Staff

COURSES FOR GRADUATE STUDENTS ONLY

SSC 622 Physical and Chemical Properties of Soils 4 (4-0) s

Prerequisites: SSC 511, SSC 522, CH 433, MA 301 or equivalents

An examination in depth of current ideas concerning the physics and chemistry of soil and clay systems. Topics will include ion exchange, molecular adsorption, electrokinetics, relations between mineral structures and their physical and chemical properties, and the properties of absorbed water. Emphasis will be determined by student interest and by current literature.
(Offered in 1965 and alternate years thereafter.)

Messrs. Miller, Weed

SSC 651 Pedology 2-3 by arrangement f

Prerequisites: SSC 522, SSC 511

A critical study of current theories and concepts in soil genesis and morphology; detailed study of soil taxonomy. Topics include weathering and clay mineral genesis as related to soil morphology and genesis, functional analyses of soil genesis, properties of and processes responsible for soil profiles formed under various sets of soil forming factors, classification theory and logic as applied to soil classification, structure of soil classifica-

tion schemes. Any of these topics may be emphasized at the expense of the others according to interests of students.
(Offered in 1965 and alternate years thereafter.)

Mr. McCracken

SSC 672 Soil Properties and Plant Development 4 credits s

Prerequisites: CH 551, SSC 522 or equivalents

A detailed examination of the effects of soil factors in the development of crop plants. Segments of the course will treat (1) soil transformation processes of both organic and inorganic constituents, (2) concepts of nutrient availability and (3) the relation of plant development indices to specific soil properties.
(Offered in 1964 and alternate years thereafter.)

Messrs. Bartholomew, Davey, Jackson

SSC 690 Seminar 1 (1-0) f s

Prerequisite: Graduate standing in Soil Science

Scientific articles, progress reports in research and special problems of interest to agronomists reviewed and discussed.

Graduate Staff

SSC 699 Research credits by arrangement

Prerequisite: Graduate standing in Soil Science

A maximum of six credits is allowed toward the master's degree, but any number toward the doctorate.

Graduate Staff

STATISTICS

See Experimental Statistics.

TEXTILES

COURSES FOR UNDERGRADUATES

TEXTILE CHEMISTRY

TC 201 Textile Chemistry I 2 (2-0) f s

Prerequisites: CH 103, TX 281

Required of juniors in Textile Technology.

A comprehensive course designed to familiarize the student with the chemical properties of all natural and man-made fibers; some emphasis is placed upon the relationship between molecular structure and physical properties; the principles and methods for producing man-made fibers are discussed; a brief survey of organic chemistry is included, particularly those parts that relate to polymer chemistry. Two one-hour lectures per week.

Mr. Rutherford

TC 303, 304 Textile Chemistry III 3 (2-3) f s

Prerequisites: CH 221, CH 223

Required of juniors in Textile Chemistry.

A study of the action of chemicals on fibers; chemistry and methods of water softening; scouring, bleaching, mercerization and dyeing of textile

materials; preparation of typical dyestuffs and their application to natural and synthetic fibers. Two 1-hour lectures and one 3-hour laboratory period per week. Mr. Hayes

TC 307 Textile Chemistry II 4 (3-2) f

Prerequisite: TC 201

Required of seniors in Textile Technology.

A comprehensive course covering the scouring, bleaching, and dyeing of fibers. Also, fabric finishing, effects of heat and chemicals on fibers, and the economic aspects of different dyes and chemical treatments on natural and synthetic fibers and fabrics. Three 1-hour lectures and one 2-hour laboratory period per week. Mr. Hayes

TC 403, 404 Textile Chemical Technology 3 (3-0) f s

Prerequisites: TC 304, CH 223

Required of seniors in Textile Chemistry.

Basic principles are applied to the study of three important areas of textile processing: dyeing, printing, and finishing. These areas are concerned with the chemical nature of dyes and other chemical agents applied to fibrous systems; with the chemical and physical properties of the various fibers; and with the mechanical aspects of the application of chemical materials to fibers and fabrics. The course includes an extensive review of the various classes of dyes and their application to all important textile fibers and blends of fibers; a comparative analysis of dyeing machinery and processes involving special machinery and equipment; a survey of modern preparatory and bleaching for all important fibers; a study of the roller printing machine, and the principles involved in print formulations for the major classes of dyes and their application to the various fibers; a study of important mechanical, additive and chemical modification type finishes for fabric. Three 1-hour lectures per week. Mr. Campbell

TC 405, 406 Textile Chemical Technology Laboratory 2 (0-6) f s

Required of seniors in Textile Chemistry.

To be taken concurrently with TC 403, 404. Two 3-hour laboratories per week.

TC 412 Textile Chemical Analysis II 3 (2-3) f

Prerequisites: CH 215, TC 304, or permission of instructor

Required of seniors in Textile Chemistry.

Analysis of textile materials involving specialized instruments and techniques such as spectrophotometry, chromatography, viscometry, electrometric titrations, etc. Two 1-hour lectures and one 3-hour laboratory period per week. Mr. Cates

TC 421 Fabric Finishing I 2 (2-0) s

Prerequisite: TC 201

Elective for students in Textile Technology only.

A general course in fabric finishing designed for students not majoring in Textile Chemistry. Emphasis is placed on stabilization finishes, and on agents for water repellency, crease resistance, moth and mildew proofing, fire proofing, etc. Some mechanical finishing (such as crepeing, napping) is also included. Two 1-hour lectures per week. Mr. Hayes

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

TC 501 Seminar in Textile Chemistry 2 credits s

Prerequisite: TC 403

Required of seniors in Textile Chemistry.

The course is designed to familiarize the student with the principal

sources of textile chemical literature and to emphasize the importance of keeping abreast of developments in the field of textile chemistry. Particular attention is paid to the fundamentals of technical writing. Reports. Lectures arranged. Mr. Campbell, Staff

TC 521 Textile Chemical Analysis III 3 credits f s

Prerequisite: TC 421 or permission of instructor

Elective for students in Textile Technology.

No credit allowed for students majoring in Textile Chemistry.

The work includes a survey of organic chemistry, with emphasis on organic surfactants, warp sizes, and fabric finishes of all types; the identification of fibers by chemical means; the qualitative and quantitative analysis of fiber blends by chemical means; the identification of finishes; the evaluation techniques for dyed and finished materials. Two one-hour lectures and one three-hour laboratory period per week.

Graduate Staff

TC 561 (CH 561) Chemistry of Fibers 3 (3-0) f

Prerequisite: CH 223

Required of seniors in Textile Chemistry.

A lecture course emphasizing the theory of fiber structure; the relationship between the chemical structure and physical properties of natural and man-made fibers; the nature of the chemical reactions which produce degradation of fibers; the production of man-made fibers. Three 1-hour lectures per week. Mr. Rutherford

TC 562 (CH 562) Chemistry of High Polymers 3 (3-0) s

Prerequisite: CH 431

Elective for Textile Chemistry students.

Mechanism and kinetics of polymerization; molecular weight description; structure of polymers. Three 1-hour lectures per week.

Mr. Cates

COURSES FOR GRADUATES ONLY

TC 605 Physical Chemistry of Dyeing 3 arranged f s

Prerequisite: CH 433

Development of principles of thermodynamics, emphasizing applications in dye and fiber chemistry.

Mr. Cates

TC 606 Chemistry of Fiber-Forming High Polymers 3 arranged f

Prerequisite: CH 431

Composition and structure of high polymers; properties of linear polymers with particular emphasis on mechanical behavior; interaction between polymers and organic substances; theory of polymer solutions.

Mr. Cates

TC 698 Seminar for Textile Chemistry 1 credit

Discussion of current scientific publications; review and discussion of student papers and research problems. Graduate Staff

TC 699 Textile Research for Textile Chemistry credits by arrangement

Original research on a problem to furnish material for a thesis.

Graduate Staff

COURSES FOR UNDERGRADUATES

TEXTILE TECHNOLOGY

TX 221 Fundamentals of Textiles 4 (3-2) f s

Corequisite: MA 111

Required of students in all Textile curricula.

Flow of various textile materials from fiber through woven fabric, nomenclature of textile machinery, basic calculations of machinery constants, basic production calculations, yarn numbering systems, yarn and fabric constructions, and loom identification. Three 1-hour lectures and one 2-hour laboratory period per week. Staff

TX 261 Fabric Structure 4 (3-2) f s

Prerequisite: TX 221

Required of students in all Textile curricula.

A technical study of the fundamental principles of fabric construction and weave formation of selected staple fabrics. Basic studies on relative importance of physical and aesthetic factors involved in woven fabrics. Laboratory instruction is given in physical analysis and design techniques essential to the development of technical specifications for the production of woven fabrics. Three 1-hour lectures and one 2-hour laboratory period per week. Messrs. Berry, Klibbe

TX 271 Upholstery Fabrics 2 (2-0) s

Required of students in Furniture Manufacturing.

Textile students may not take this course for degree credit.

A study of the basic principles of textile manufacturing and structure of woven fabrics, identification of classic decorative fabrics used for upholstered furniture coverings, with emphasis on nomenclature and physical properties and textile trade customs. Two 1-hour lecture periods per week. Mr. Berry

TX 281 Fiber Quality 4 (3-2) f s

Prerequisite: TX 221

Required of students in all Textile curricula.

A study of the physical, chemical and aesthetic properties of the major natural and man-made textile fibers. Included are methods of measuring fiber properties and interpretation of test results, complete analysis of typical fiber and yarn stress-strain curves, influence of fiber moisture regain on physical properties and processing characteristics, end use application in textile and industrial fabrics, properties of fabrics made from blends of different fibers, and fiber identification by laboratory analysis. Three 1-hour lectures and one 2-hour laboratory period per week. Messrs. Moser, Wiggins

TX 303 Fiber and Yarn Technology 4 (3-2) f s

Prerequisite: TX 281

Required of all students in the Textile Technology curriculum.

Technological and scientific concepts of fiber and yarn structures and modifications resulting from processing. For all systems, the opening, cleaning and carding actions; blending of fibers stressing intimacy, methods, effectiveness, and influence on product; yarn structure as a factor of blend, fiber distribution, twist in its many ramifications, spinning limits; composite yarn structures; bulk and yarn coverage; drafting methods, types, and limits. Three 1-hour lectures and one 2-hour laboratory period per week. Messrs. Lassiter, Pardue

TX 304 Fiber and Yarn Technology 4 (3-2) f s

Prerequisite: TX 303

Required of students in Fiber and Yarn Technology and General Textiles, elective for others.

Technological and economic aspects of fiber and yarn processing including: packaging, production and efficiency levels; specialized yarn processes such as combing with economic justifications; design and use of specialty novelty yarns; economical and mechanical limitations of textile equipment. Three 1-hour lectures and one 2-hour laboratory period per week.

Messrs. Pardue, Stuckey

TX 327 Textile Testing 4 (3-2) f s

Prerequisites: TX 303, TX 365, ST 361

Required of students in all Textile curricula.

Quality control methods for textile processing, with emphasis on the measurement by laboratory instruments and techniques, and including a study of the mechanical and natural influences involved. Three 1-hour lectures and one 2-hour laboratory period per week.

Messrs. Hamby, Stuckey

TX 365 Fabric Technology 4 (3-2) f s

Prerequisites: TX 261, TX 281

Required of students in the Textile Technology curriculum.

Geometry of fabrics; properties of fabrics dependent on the weave, geometrical configurations and yarn properties, such as compressional resilience, air and water permeability, water repellency, creasing tendencies, abrasion properties, hand, and drape. Mechanical properties of fabrics; transmission of heat, moisture, and air. Yarn additives and treatments; slashing and warp preparation, materials, and techniques. Nonwoven structures. Three 1-hour lectures and one 2-hour laboratory period per week.

Messrs. Berry, Porter

TX 366 Fabric Technology 4 (3-2) f s

Prerequisite: TX 365

Required of students in Fabric Technology and General Textiles, elective for others.

Technology and economic aspects of fabric construction, design, and production. The classical weaves, their design, inherent uses, production techniques, and types of looms required. Marketing methods, with Worth Street and other trade rules and regulations. The loom as a production unit: types, nomenclature, basic and special mechanisms. Mill balance. Fabric defects. Three 1-hour lectures and one 2-hour laboratory per week.

Messrs. Berry, Moser

TX 430 Continuous Filament Yarns 3 (2-2) f s

Prerequisite: TX 303

Required of students in Fiber and Yarn Technology and Knitting Technology, elective for others.

A study of properties and processes applicable only to filament yarns such as texturizing and bulking. Detailed studies of throwing systems, engineering requirements of equipment, and yarn property changes resulting from processing. Two 1-hour lectures and one 2-hour laboratory period per week.

Mr. Wiggins

TX 436 Staple Fiber Processing 3 (2-2) f s

Prerequisite: TX 303

Required of students in Fiber and Yarn Technology, elective for others.

A study of special systems of processing long staple, natural and man-made fibers, including woolen, worsted, direct spinning, Turbo Stapler or Pacific Converter, and sliver to yarn methods. New concepts and research findings as applied to all yarn processes. Two 1-hour lectures and one 2-hour laboratory period per week. Mr. Pardue

TX 478 Design and Weaving 3 (2-2) f s

Prerequisite: TX 366

Required of students in Fabric Technology, elective for others.

Advanced study of special weave formations and the techniques and equipment necessary to form these fabrics. Studies in depth of new developments and research findings in the areas of warp preparation, design, weaving, and fabric formation. Two 1-hour lectures and one 2-hour laboratory period per week. Messrs. Berry, Porter

TX 483 Textile Cost Methods 3 (3-0) f s

Prerequisites: TX 303, TX 365

Required of seniors in Textile Technology.

A study of cost methods applicable to textile costing with emphasis on decision making. Interpretation of cost reports and their use in pricing and cost control. Three 1-hour lectures per week.

Messrs. King, Lynch

TX 485 Mill Design and Organization 4 (3-2) f s

Prerequisites: TX 303, TX 365

Required of students in the Textile Technology curriculum during last or next to last semester in residence.

Detailed analysis of waste losses in the textile mill and relationship to cost. Application of economic principles of textile marketing, factoring, hedging, and other buying and selling problems. Organization, planning and scheduling, inventory control and departmental functions of textile companies. Automation as applied to textile processing in grey mills. Technical problems of plant site selection, plant design and layout, and selection of equipment. Design and layout of a mill from raw fiber to grey fabric by each student. Three 1-hour lectures and one 2-hour laboratory period per week. Messrs. Grover, Wiggins

TX 490 Development Project I 1-3 f s

Prerequisites: Senior standing and permission of instructor

Elective.

A problem of independent study assigned to seniors in the major field of study serving also as the laboratory period for senior level courses. One 2-hour laboratory period per week per credit. Staff

KNITTING TECHNOLOGY

TX 342 Knitting Principles 2 (2-0) f s

Prerequisites: TX 221, TX 281

Required of juniors in Textile Technology and Knitting Technology.

A basic course in knitted fabric construction with emphasis on the many types of stitch structures found in knitted textiles. Attention is also devoted to the equipment and mechanisms necessary to produce these structures. Two 1-hour lecture periods per week.

Messrs. Li, Middleton

TX 441 Flat Knitting 3 (2-2)f

Prerequisite: TX 342

Required of seniors in Knitting Technology, elective for others.

A study of the leading types of flat knitting machines including warp knitting machines, design possibilities and fabric adaptability. Two 1-hour lectures and one 2-hour laboratory period per week. Mr. Shinn

TX 442 Knitted Fabrics 3 (2-2) f s

Prerequisite: TX 342

Required of seniors in Textile Technology and Knitting Technology.

Design, analysis, and production of knitted fabrics, including flat, circular, and warp types. The economic aspects of the knitting process as a method of clothing production. Introduction to garment design, production and marketing. Two 1-hour lectures and one 2-hour laboratory period per week. Messrs. Middleton, Shinn

TX 444 Garment Manufacture 3 (2-2) s

Prerequisite: TX 342

Required of seniors in Knitting Technology, elective for others.

A study of circular latch needle and spring needle machines for knitted fabric production. Styling, cutting and seaming of the basic garment types for underwear and outerwear; standard seam types; high-speed sewing machines. Two 1-hour lectures and one 2-hour laboratory period per week. Mr. Shinn

TX 447, 448 Advanced Knitting Laboratory 2 (0-4) f s

Prerequisite: TX 342

Required of seniors in Knitting Technology, elective for others.

Systematic study of circular hosiery mechanisms; hosiery types and constructions. Seamless hosiery production methods utilizing the newer synthetic yarns, toe closing methods, finishing processes, and marketing are emphasized. Messrs. Middleton, Shinn

TX 449 Tricot Knitting 3 (2-2) s

Prerequisite: TX 342

Elective for juniors and seniors.

A study of basic types of tricot knitting machines with emphasis on mechanisms and fabrics. Attention is given to warp preparation methods applicable to the tricot machine, the characteristics of yarn made from natural and synthetic fibers as they affect processing into warp knitted fabrics; machine settings for proper qualities and ratios; economics of warp knitting, and end uses. Attention is given to fabric design and analysis. Two 1-hour lectures and one 2-hour laboratory period per week. Mr. Shinn

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

TEXTILE TECHNOLOGY

TX 521 Textile Testing II 3 (2-3) f

Prerequisite: TX 327

Advanced techniques for measuring properties of natural and man-made fibers, yarns, and fabrics. Interrelations of raw material, quality, processing characteristics, and end product properties. The application of the laws of physical sciences to evaluation of textile materials. Two 1-hour lectures and one 3-hour laboratory per week. Messrs. Hamby, Stuckey

TX 522 Textile Quality Control 3 (2-3) s

Prerequisite: TX 521

Elective.

Quality control systems for textile operations. Defect prevention methods, isolation of processes contributing to substandard quality, relationship between quality control department and operating divisions. Laboratory design, equipment and personnel selection, installation of quality control systems. Two 1-hour lectures and one 3-hour laboratory period per week.

Messrs. Hamby, Stuckey

TX 525 Advanced Textile Microscopy 2 arranged f s

Prerequisite: TX 327

Elective.

Experiments, lectures and demonstrations in more advanced techniques of textile microscopy. Detailed studies of structures of fibers covered in lecture series, and supplemented by experiments on lecture topics. Detailed study of all types of microscopes and their uses in textiles. Preparation of slides for photography. Uses of photomicrographic equipment. Lectures and laboratory arranged.

Mr. Stuckey

TX 551 Complex Woven Structures 4 (3-2) s

Prerequisites: TX 303, TX 478

Elective.

The development of design specifications for complex fabrics as related to fabric geometry, functional and aesthetic properties and manufacturing limitations. Three 1-hour lectures and one 2-hour laboratory per week.

Mr. Berry

TX 575 Fabric Analytics and Characteristics 3 (3-0) f s

Prerequisite: TX 365 or TX 366 or TC 561

Required of students in Fabric Technology, elective for others.

Correlation of fiber and yarn properties with those of the fabric. Fabric design features related to utilitarian as well as aesthetic values, with case studies of successful fabrics. Inspection and classification of defects with economic aspects. Engineering design of fabrics utilizing blends of fibers and yarns. Three 1-hour lectures per week.

Mr. Porter

TX 590 Special Projects in Textiles 1 to 3 f s

Prerequisites: TX 327, senior standing, permission of instructors

Elective.

Special studies in either the major or minor field of the advanced undergraduate or graduate student. These special studies will take the form of current problems of the industry, independent investigations in the areas of textile testing and quality control, seminars and technical presentations, both oral and written.

Staff

GENERAL TEXTILE COURSES

TX 581 Instrumentation and Control 3 (2-2) f s

Prerequisite: PY 212

Required of all seniors in all Textile curricula.

A lecture series with coordinated laboratory exercises designed to familiarize the student with the theory and application of instruments and control apparatus found in the modern textile plant. The studies cover the measurement and control of temperature, humidity, pressure, flow and liquid level, the application of control apparatus to chemical processes and physical finishing of textile products. Two 1-hour lectures and one 2-hour laboratory period per week.

Mr. Asbill

TX 598 Textile Technology Seminar 2 (2-0) s

Prerequisites: Senior standing and permission of instructor

Elective.

Lecture and discussion periods are designed for students who are particularly interested in yarn manufacturing aspects of the textile industry. Subject matter will include such aspects as training methods, safety programs, modern mill design, specialized techniques in setting rates, employee relations and developments that arise from technical meetings. Two 1-hour lectures per week. Messrs. Grover, Hamby

COURSES FOR GRADUATES ONLY

TX 601, 602 Yarn Technology 3 arranged f s

Prerequisite: Graduate standing

This course provides the student with an opportunity for intensive study of advanced topics in the field of yarn technology.

Messrs. Grover, Hamby

TX 621 Textile Testing III 2 (1-2) f s

Prerequisite: TX 522 or equivalent

Design of textile laboratories, including conditioning equipment and instruments required for specific needs; performance of tests and analysis of data on industrial problems; specialized physical tests; inter-laboratory tests and analysis; study of A.S.T.M. specifications and work on task groups for the A.S.T.M. Society. One 1-hour lecture and one 2-hour laboratory period per week. Mr. Hamby

TX 631 Synthetic Fibers 2 arranged s

Prerequisite: TX 430 or TX 436 or equivalent

Lectures and projects on advanced problems relative to the properties and processing of man-made continuous filament and staple fiber yarns.

Messrs. Grover, Hamby

TX 641, 642 Advanced Knitting Systems and Mechanisms 3 arranged f s

Prerequisite: TX 441 or equivalent

A critical study of inventions which have contributed to the development of the modern knitting industry; knitting needles and their adaption for specific uses; means for mounting them for individual and en masse operation; construction and functioning of cooperating elements including sliders, jacks, sinkers, dividers, pressing elements, narrowing and tensioning and draw-off motions, regulating mechanisms, timing and control chains and cams. Use will be made of patent literature which covers important developments in the hosiery industry. Three 1-hour lectures per week.

Mr. Shinn

TX 643, 644 Knitting Technology 3 (2-2) f s

Prerequisites: Graduate standing and 8 credits in Knitting Technology

Problems of specific interest to the knitting industry will be assigned for study and investigation. The use of experimental methods will be emphasized. Attention will be given to the preparation of reports for publication.

Graduate Staff

TX 651, 652 Fabric Development and Construction 3 arranged f s

Prerequisite: Graduate standing

Application of advanced technology to the development and construction of woven fabrics. Graduate Staff

TX 698 SEMINAR 1 (1-0) f s

Discussion of current scientific publications of interest to the textile industry; review and discussion of student papers and research problems.

Graduate Staff

TX 699 TEXTILE RESEARCH credits by arrangement

Problems of specific interest to the textile industry will be assigned for study and investigation. The use of experimental methods will be emphasized. Attention will be given to the preparation of reports for publication. The master's thesis may be based upon the data obtained.

Graduate Staff

ZOOLOGY

COURSES FOR UNDERGRADUATES

BS 100 (See listing under Biological Science) 4 (3-2) f s

ZO 201 ANIMAL LIFE 4 (3-3) f s

Prerequisite: BS 100

The biology of the major groups of animals, with emphasis on general structural plans and diversity, reproduction, development, ecology, behavior, and evolution. Mr. Quay

ZO 212 HUMAN ANATOMY 3 (2-2) f

Prerequisite: BS 100

A study of human anatomy with major emphasis on the structure and function of the muscular, skeletal, circulatory and nervous systems. Required of majors in Recreation. Staff

ZO 213 HUMAN PHYSIOLOGY 3 (3-0) s

Prerequisite: ZO 212 or permission of instructor

A survey of human physiology. The central theme is the changes in the human body accompanying physical activity. The nature and mechanisms of these changes. Staff

ZO 214 HUMAN PHYSIOLOGY 1 (0-3) s

Corequisite: ZO 213

Laboratory in Human Physiology. Required of students in Nurses' Program. Staff

ZO 221 CONSERVATION OF NATURAL RESOURCES 3 (3-0) f

Prerequisite: BS 100

The importance of natural resources to man and the part they play in his environment. The physical, biological and ecological principles underlying natural resource conservation with particular attention given to the biological consequences of overexploitation and environmental pollution.

ZO 223 COMPARATIVE ANATOMY 4 (2-4) f s

Prerequisite: ZO 201 or permission of instructor

A comparative morphology of vertebrates demonstrating the interrelationships of the organ systems of the various groups. Mr. Harkema

ZO 315 ANIMAL PARASITOLOGY 3 (2-3) s
Prerequisite: ZO 201

This course is designed to give students a knowledge and appreciation of the life history, pathology and control of the common parasites of animals.
Messrs. Harkema, Miller

ZO 345 HISTOLOGY 4 (2-4) f
Prerequisite: ZO 223

The microscopic anatomy of animal tissues. Staff

ZO 361 ANIMAL EMBRYOLOGY 4 (2-4) s
Prerequisite: ZO 223 or permission of instructor

The study of fundamental principles which apply to the embryonic development of vertebrates.
Mr. Alliston

ZO 401 ORNITHOLOGY 3 (2-3) s
Prerequisite: ZO 201

The biology and classification of birds. Field trips for the study and identification of local forms, including trips to Lake Mattamuskeet and to the coast. Individual research projects on nesting populations.
Mr. Quay

ZO 420 FISHERY SCIENCE 3 (2-3) f
Prerequisites: ZO 201, ZO 442

The science of fishery biology; life history and biology of important game and commercial fishes, fishing methods, age and growth analysis, survey of fishery resources, tagging studies, population estimations and pollution studies.
Messrs. Hassler, Hester

ZO 421 ANIMAL PHYSIOLOGY 4 (3-3) f s
Prerequisites: Organic Chemistry, Physics, ZO 201 or permission of instructor

Physiology of vertebrates with emphasis on mammals. A comprehensive study of the mechanisms which operate to sustain life.
Messrs. Alliston, Santolucito

ZO 441 ICHTHYOLOGY 3 (2-3) s
Prerequisite: Consent of instructor

The classification and ecology of selected groups of fishes. Lectures, laboratories, and field trips dealing with the systematics, life histories, interrelationships, and distribution of the particular groups of fishes.
Mr. Hassler

ZO 442 (BO 442) GENERAL ECOLOGY 4 (3-3) s
Prerequisite: ZO 201, BO 301 or equivalent

The general principles of the interrelationships among organisms, and between organisms and their environments—land, fresh-water, and marine.
Messrs. Cooper, Quay

ZO 450 INVERTEBRATE ZOOLOGY 4(3-3) s
Prerequisite: ZO 201

The biology and classification of the invertebrate animals with special reference to types commonly encountered and to those which illustrate zoological principles.
Mr. Berger

ZO 513 COMPARATIVE ANIMAL PHYSIOLOGY 4 credits f
Prerequisite: ZO 421

The comparative physiology of selected systems. Topics for detailed con-

sideration in lectures, collateral reading, and class discussion, will include the nervous, circulatory, digestive, and respiratory systems.

ZO 517 Population Ecology 3 credits s

Prerequisites: ZO or BO 442 and ST 511 or permission of instructor

The dynamics of natural populations. Current work, theories and problems dealing with population growth, fluctuation, limitation and patterns of dispersion, the ecological niche, food chains and energy flow.

Mr. Hayne

ZO 524 (PO 524) Comparative Endocrinology 3 (2-3) s

Prerequisite: ZO 421 or equivalent

Study of the endocrine system with respect to its physiological importance to metabolism, growth, and reproduction. Laboratory techniques and demonstrations. Mr. Garren

ZO 532 (GN 532) Biological Effects of Radiation 3 (3-0) s

Prerequisite: Undergraduate biological background or approval of instructor

Qualitative and quantitative effects of radiation on biological systems; to include both morphological and physiological aspects in a consideration of genetics, cytology, histology and morphogenesis. Mr. Grosch

ZO 540 (GN 540) Evolution 3 (3-0) f

Prerequisite: GN 411

The facts and theories of evolution in plants and animals. The causes and consequences of organic diversity. Mr. Smith

ZO 542 Herpetology 3 credits s

Prerequisites: ZO 223, ZO 421

The biology of the amphibians and reptiles: systematics, life history, anatomy, behavior, physiology, and ecology. Staff

ZO 544 Mammalogy 3 (1-4) s

Prerequisites: BS 100, ZO 201 and approval of instructor

The classification, identification, and ecology of the major groups of mammals. Mr. Barkalow

ZO 550 (GN 550) Experimental Evolution 3 (3-0) s

Prerequisites: GN 512, GN 513 or permission of instructor

Review of the biological concepts associated with phyletic evolution and speciation. Mr. Mettler

ZO 551 Wildlife Science 3 (2-3) f

Prerequisite: ZO 201

The principles of wildlife managment and their application are studied in the laboratory and in the field. Mr. Barkalow

ZO 552 Wildlife Science 3 (2-3) s

Prerequisite: ZO 551

The principles of wildlife management and their application are studied in the laboratory and in the field. Mr. Barkalow

ZO 555 Protozoology 4 credits f

Prerequisite: ZO 450 or permission of instructor

The biology of the Protozoa: lectures include morphology, physiology, ecology, genetics, reproduction, evolution, systematics, and life-cycles of both free-living and parasitic taxa; laboratory will stress recognition of selected forms and demonstrate techniques used to prepare specimens for microscopic examination. Mr. Berger

ZO 581 PARASITOLOGY I 4 (2-4) f

Prerequisite: ZO 223

The study of the morphology, biology and control of the parasitic protozoa and helminths of man, domestic and wild animals. (Offered in 1965 and alternate years.) Mr. Harkema

ZO 582 (ENT 582) MEDICAL AND VETERINARY ENTOMOLOGY 3 (2-3) s

Prerequisite: ENT 301 or ENT 312

A study of the morphology, biology and control of the parasitic arthropods of man, domestic and wild animals. (Offered in 1966 and alternate years.) Messrs. Farrier, Harkema

ZO 588 CELL PHYSIOLOGY 3 (3-0) s

Prerequisite: ZO 421 or BO 421 or permission of instructor

A study of fundamental physiological properties at the cellular level with emphasis on theoretical principles. Messrs. Santolucito, Troyer

ZO 589 CELL PHYSIOLOGY LAB 1 (0-3) s

Corequisite: ZO 588 or BO 588

Experimental approaches in the study of physiological processes at the cellular level. Attention will be devoted to the theoretical usefulness of laboratory techniques along with their practical limitations.
Messrs. Santolucito, Troyer

ZO 590 SPECIAL STUDIES credits by arrangement

Prerequisite: Approval of instructor

A directed individual investigation of a particular problem in Zoology, accompanied by a review of the pertinent literature. A maximum of three credits allowed toward the bachelor's degree, six toward the master's degree and nine toward the doctorate. Staff

ZO 603 ADVANCED PARASITOLOGY 3 (2-3) s

Prerequisite: ZO 581

A study of the theoretical and practical aspects of parasitism; taxonomy, physiology, and immunology of animal parasites. Mr. Harkema

ZO 604 (ANS 604) EXPERIMENTAL ANIMAL PHYSIOLOGY 4 (2-4) f

Prerequisite: ZO 513 or equivalent

A study of the theories and techniques involved in physiological investigation. Messrs. Ulberg, Wise

ZO 621 FISHERY SCIENCE 3 credits f

Prerequisites: ZO 480, ST 511, and a course in calculus

An analysis of fishery research methods. Population enumeration and dynamics. The relationship between natural fluctuations in population and environmental factors. (Offered in 1965 and alternate years.)
Mr. Hassler

ZO 690 SEMINAR 1 (1-0)

The presentation and defense of original research and current literature.
Staff

ZO 699 RESEARCH IN ZOOLOGY credits by arrangement

Prerequisite: Approval of instructor

Original research related to the student's thesis. A maximum of six credits is allowed toward the master's degree, but any number toward the doctorate. Staff

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Assistant Extension Editor, Agricultural Information, B.S., North Carolina State of the U. of N. C. at Raleigh

CHARLES DOUGLAS BRYANT
Assistant Professor of Agricultural Education, B.S., M.AG.ED., North Carolina State of the U. of N. C. at Raleigh. ED.D., Michigan State University

RALPH CLEMENT BRYANT
Professor of Forest Management, B.S., M.F., Yale University; PH.D., Duke University

---

* Leave of absence, September, 1964-June, 1965.

JAMES SAMUEL BUCHANAN
Extension Professor of Animal Science, B.S., Virginia Polytechnic Institute

ROBERTS COZART BULLOCK
Professor of Mathematics, B.A., M.A., University of North Carolina at Chapel Hill; PH.D., University of Chicago

CARL LEE BUMGARDNER
Associate Professor of Chemistry, B.A.SCI., University of Toronto; PH.D., Massachusetts Institute of Technology

*HARVEY LINDY BUMGARDNER
Extension Associate Professor of Poultry Science, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., PH.D., University of Maryland

FRANCIS FREDRICK BUSTA
Assistant Professor of Food Science. A.B., M.S., University of Minnesota; PH.D., University of Illinois

RONALD CLARK BUTLER
Counselor in Admissions and Registration, B.S., East Carolina College; M.ED., University of North Carolina at Chapel Hill

THOMAS MITCHELL BYRD
Associate News Editor, Agricultural Information, B.S., University of North Carolina at Chapel Hill

BETTY ANN CAGLE DOUGHERTY
Research Instructor in Textile Technology, B.S., M.S., University of North Carolina at Greensboro

FRED VIRGIL CAHILL, JR.
Dean of the School of Liberal Arts and Professor of History and Political Science, B.A., M.A., University of Nebraska; PH.D., Yale University

JOHN TYLER CALDWELL
Chancellor of North Carolina State of the U. of N. C. at Raleigh and Professor of Political Science, B.S., Mississippi State College; A.M., Duke University; M.A., Columbia University; PH.D., Princeton University

KENNETH STODDARD CAMPBELL
Professor of Textile Chemistry, B.S., Bates College; B.S., Clemson College

MALCOLM EUGENE CAMPBELL
Dean of the School of Textiles and Professor of Textiles, Graduate, New Bedford Institute of Textiles and Technology; B.S., Clemson College; M.S. (Hon.), New Bedford Institute of Textiles and Technology; D.TEX., Philadelphia Textile Institute, Clemson College; DR. HONORIS CAUSA, National University of Engineering, Lima, Peru

WILLIAM VERNON CAMPBELL
Associate Professor of Entomology, B.S., M.S., Mississippi State College; PH.D., North Carolina State of the U. of N. C. at Raleigh

EMMETT JOHN CANADAY
Assistant Professor of Mathematics, B.A., William Jewell College; M.A., University of Missouri

THOMAS FRANKLIN CANNON
Research Associate Professor of Horticultural Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Ohio State University

GEORGE LaFAYETTE CAPEL
Extension Professor of Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of Florida

THELMA JOYCE CARAWAY
Assistant Professor of Mathematics, A.B., Alabama College; M.A., University of Arkansas

EDGAR F. CARELL
Research Associate in Botany and Bacteriology, B.S., King Fouad University (Cairo); M.S., University of California at Los Angeles; PH.D., Rutgers University

HALBERT HART CARMICHAEL
Assistant Professor of Chemistry, B.S., PH.D., University of California at Berkeley

ALBERT CARNESALE
Instructor in Nuclear Engineering, B.M.E., Cooper Union; M.S.M.E., Drexel Institute of Technology

---

* Leave of absence, January, 1963-December, 1964.

WILLIAM LESTER CARPENTER
Head of Agricultural Information, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., University of Wisconsin

ROBERT B. CARR
Assistant Professor of Military Science, B.S., North Carolina State of the U. of N. C. at Raleigh

ADGER BOWMAN CARROLL
Instructor in Agricultural Economics, B.S., M.S., Clemson College

WARREN CARROLL
Wolfpack Club Director, Athletics

ROBERT GORDON CARSON, JR.
Director of Instruction, School of Engineering and Professor of Industrial Engineering, B.S., Clemson College; M.S., Georgia Institute of Technology; PH.D., University of Michigan, PROF. ENG.

ROY MERWIN CARTER
Professor of Wood Technology, B.S.F., University of Minnesota; M.S., Michigan State College

EDWARD VITANGELO CARUOLO
Assistant Professor of Animal Science, B.S., University of Rhode Island; M.S., University of Connecticut; PH.D., University of Minnesota

LEO THOMAS CARUTHERS
Radiological Safety Officer of the Safety and Health Committee, B.S., University of Richmond

EVERETT N. CASE
Varsity Basketball Coach, Athletics, B.A., University of Wisconsin; M.S., University of Southern California

WILLIS R. CASEY
Swimming Coach, Athletics, B.A., University of North Carolina at Chapel Hill

GUY REED CASSELL
Extension Associate Professor of Agricultural Economics, B.A., West Viriginia University; M.S., University of Maryland

ROBERT B. CATE, JR.
Visiting Assistant Professor of Soil Science, A.B., Dartmouth College; M.S., North Carolina State of the U. of N. C. at Raleigh

DAVID MARSHALL CATES
Research Professor of Textile Chemistry, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; M.A., PH.D., Princeton University

JOHN WESLEY CELL
Head of Department and Professor of Mathematics, B.A., M.A., PH.D., University of Illinois

RICHARD BRUCE CHALFANT
Assistant Professor of Entomology, B.S., University of Akron; M.S., PH.D., University of Wisconsin

EVERETT EUGENE CHAMBERS
Assistant Professor of Horticultural Science, B.S., PH.D., University of Wisconsin

DOUGLAS SCALES CHAMBLEE
Professor of Crop Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Iowa State College

LARRY STEPHEN CHAMPION
Assistant Professor of English, A.B., Davidson College; M.A., University of Virginia; PH.D., University of North Carolina at Chapel Hill

NORMAN M. CHANSKY
Associate Professor of Education and Psychology, B.S., M.ED., Boston University; PH.D., Columbia University

JOE SENTER CHAPPELL
Assistant Professor of Agricultural Economics, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., Oklahoma State University; PH.D., North Carolina State of the U. of N. C. at Raleigh

JOHN ALLEN CHRISTIAN
Extension Professor of Food Science, B.S., M.S., Pennsylvania State University

WAVERLY THOMAS CHUMNEY
Research Instructor in Agricultural Economics, B.S., M.S., Virginia Polytechnic Institute

JOHN G. CLAPP
Extension Instructor in Crop Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

EDGAR WILLIAM CLARK
Adjunct Assistant Professor of Entomology, B.S., PH.D., University of California

VIRGIL SCOVILLE CLARK
Assistant Professor of Air Science, B.S., East Carolina College

JAMES EDWIN CLARKE, JR.
Instructor in Civil Engineering, B.S., M.E., University of South Carolina

LEWIS JAMES CLARKE
Professor of Landscape Architecture, DIP. IN ARCH., School of Arch., Leicester; DIP. IN L.D., King's College, University of Durham (England); M.L.A., Harvard University

JOHN MONTGOMERY CLARKSON
Professor of Mathematics, B.A., Wofford College; M.A., Duke University; PH.D., Cornell University

ALBERT J. CLAWSON
Associate Professor of Animal Science, B.S., University of Nebraska; M.S., Kansas State College; PH.D., Cornell University

CARLYLE NEWTON CLAYTON
Professor of Plant Pathology, B.S., Clemson College; PH.D., University of Wisconsin

MAURICE HILL CLAYTON
Associate Professor of Engineering Mechanics, B.S., Wake Forest College; M.E., Math., North Carolina State of the U. of N. C. at Raleigh; PH.D., Virginia Polytechnic Institute

JOHN L. CLEMENTS
Assistant Professor of Physical Education, B.S., M.A., University of North Carolina at Chapel Hill

ROY BENNETT CLOGSTON
Director, Athletics and William Neal Reynolds Coliseum, Athletics, B.A., Springfield College; M.A., New York University

GROVER CLEVELAND COBB, JR.
Assistant Professor of Physics, B.S., M.S., University of Georgia; PH.D., University of Virginia

FRED DERWARD COCHRAN
Head of Department and Professor of Horticultural Science, B.S., Clemson College; M.S., Louisiana State University; PH.D., University of California

COLUMBUS CLARK COCKERHAM
Professor of Experimental Statistics and Genetics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Iowa State College

ELOISE SNOWDEN COFER
Assistant Director, Agricultural Extension Service and Extension Professor, B.S., Marshall College; M.S., Columbia University; PH.D., University of Chicago

JOSEPH DANIEL COFFEY
Instructor in Agricultural Economics, B.S., Purdue University; M.S., North Carolina State of the U. of N. C. at Raleigh

DAVID JAMES COLEMAN, JR.
Assistant Professor of Military Science, B.S., Virginia Polytechnic Institute

EMERSON ROSCOE COLLINS
Extension Professor of Crop Science, B.S., University of Pennsylvania; PH.D., Iowa State College

HERBERT COLLINS
Assistant Professor of Sociology and Anthropology, B.A., Brooklyn College; M.A., Duke University

JOHN NOLAN COLLINS
Extension Instructor in Rural Sociology, B.S., North Carolina State of the U. of N. C. at Raleigh

JOSEPH JOHN COMBS
Director, Student Health Service, Student Affairs, M.D., Columbia University

WILLIAM C. COMPTON
Assistant Professor of Genetics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of Nebraska

RICHARD P. CONNELLY
Instructor in Electrical Engineering, B.S., Syracuse University

NORVAL WHITE CONNER
Director of Engineering Research and Professor of Mechanical Engineering, B.S., M.E., Virginia Polytechnic Institute; M.S., Iowa State College; PROF. ENG.

WILLIAM STOKES CONNER, JR.
Adjunct Professor of Experimental Statistics, B.S., Davidson College; M.A., PH.D., University of North Carolina at Chapel Hill

RICHARD DE MOTT CONOVER
Extension Instructor in Animal Science, B.S., Rutgers University

FREEMAN WALDO COOK
Associate Professor of Poultry Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., A & M College of Texas

HILLIARD DUNNING COOK
Assistant Professor of Pulp and Paper Technology, B.S., Massachusetts Institute of Technology

JOHN OLIVER COOK
Professor of Psychology, B.A., University of Chicago; M.A., University of Iowa; PH.D., New York University

MAURICE GAYLE COOK
Assistant Professor of Soil Science, B.S., M.S., University of Kentucky; PH.D., Virginia Polytechnic Institute

HENRY CHARLES COOKE
Associate Professor of Mathematics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

ARTHUR WELLS COOPER
Associate Professor of Botany and Forestry, B.A., M.A., Colgate University; PH.D., University of Michigan

WILLIAM EARL COOPER
Associate Professor of Plant Pathology, B.S., Arkansas A. & M. College; M.A., Oklahoma A. & M. College; PH.D., Louisiana State University

NELVIN EUGENE COOPER
Assistant Professor of Physical Education, B.A., Elon College; M.A., University of North Carolina at Chapel Hill

ALONZO FREEMAN COOTS
Associate Professor of Chemistry, B.E., PH.D., Vanderbilt University

RALPH LELAND COPE
Assistant Professor of Industrial Engineering, B.S.M.E., B.S.IND.E., M.ED., Pennsylvania State University

WILL ALLEN COPE
Research Associate Professor of Crop Science, B.S., M.S., Alabama Polytechnical Institute; PH.D., North Carolina State of the U. of N. C. at Raleigh

FREDERICK THOMAS CORBIN
Research Assistant in Crop Science, B.S., Wake Forest College; M.ED., University of North Carolina at Chapel Hill

FRANKLIN E. CORRELL
Assistant Professor of Horticultural Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

HAROLD MAXWELL CORTER
Professor of Psychology, B.S., State Teachers' College at Lock Haven; M.ED., PH.D., Pennsylvania State University

JOHN HOWARD COSGROVE
Instructor in Chemical Engineering, B.CH.E., M.CH.E., University of Louisville

* ARTHUR JAMES COUTU
Professor of Agricultural Economics and Chief, Agricultural Mission to Peru, B.S., M.S., University of Connecticut; PH.D., North Carolina State of the U. of N. C. at Raleigh

HENRY METTEAUX COVINGTON
Extension Professor of Horticultural Science, B.S., Clemson College; M.S., Louisiana State University

TOM L. COVINGTON
Assistant Director of Student Activities, Student Affairs, A.B., Davidson College

STUART DOUGLAS COWARD
Research Engineer in Industrial Extension Service, B.S., Tri-State College; M.S., Syracuse University

FREDERICK RUSSELL COX
Assistant Professor of Soil Science, B.S., M.S., University of Nebraska; PH.D., North Carolina State of the U. of N. C. at Raleigh

JOSEPH H. COX
Professor of Design, B.F.A., John Herron Art School; M.F.A., University of Iowa

DORIS LEE CRAIG
Assistant Professor of Soil Science, B.A., Winthrop College; M.A., University of North Carolina at Chapel Hill

FRANK RANKIN CRAIG
Professor of Poultry Science, B.S., M.AG.ED., North Carolina State of the U. of N. C. at Raleigh; D.V.M., University of Georgia

HARRIS BRADFORD CRAIG
Associate Professor of Food Science, B.S., Clemson College; M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Michigan State University

WINIFRED HARDISON CRANOR
Research Instructor in Textile Chemistry, B.S., University of North Carolina at Greensboro

ALBERT ROBERT CRAWFORD
Assistant Professor of Recreation and Park Administration, B.S., Appalachian State Teachers College; M.ED., University of North Carolina at Chapel Hill

JOHN WILLIAM CRAWFORD
Extension Professor of Rural Sociology, B.S., North Carolina State of the U. of N. C. at Raleigh

PAUL DAY CRIBBINS
Associate Professor of Civil Engineering, B.S., United States Merchant Marine Academy; B.S.CSE., University of Alabama; M.S.C.E., PH.D., Purdue University

EUGENE CHARLES CRIST
Instructor in Engineering Mechanics, B.S.M.E., Johns Hopkins University; M.S., Lehigh University

JOHNNY LEE CROW
Instructor in Mechanical Engineering, B.S., North Carolina State of the U. of N. C. at Raleigh

JAMES URIAH CROWDER
Instructor in Engineering Mechanics, B.S.M.E., M.S.E.M., North Carolina State of the U. of N. C. at Raleigh

KELLY RAYGENE CRUMP
Instructor in Engineering Graphics, B.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM EUGENE CULLISON
Instructor in Economics, A.B., M.A., PH.D., University of Oklahoma

GEORGE AUGUST CUMMINGS
Assistant Professor of Soil Science, B.S.AG.ED., M.S.AG.ED., PH.D., Purdue University

---

* Leave of absence, January, 1963-January, 1965.

RAGHUNATH SINGH DAHIYA
Research Associate in Food Science, B.S., M.S., Government Agricultural College (India); PH.D., North Carolina State of the U. of N. C. at Raleigh

ROBERT DAVID DAHLE
Extension Instructor in Agricultural Economics, B.S., M.S., Pennsylvania State University

THOMAS BARKER DAMERON, JR.
Adjunct Associate Professor of Poultry Science, B.S., The Citadel; A.B., University of North Carolina at Chapel Hill; M.D., Duke University

EDMUND PENDLETON DANDRIDGE
Associate Professor of English, A.B., Kenyon College; M.A., University of Michigan; PH.D., University of Virginia

HARRY TAYLOR DANIEL
Information Specialist in Agricultural Information, B.S., North Carolina State of the U. of N. C. at Raleigh

JUSTICE GREY DANIEL
Driver Trainer, Division of General Extension, Driver Training School

WALTER CARL DAUTERMAN
Associate Professor of Entomology, B.S., M.S., Rutgers University; PH.D., University of Wisconsin

DONALD GOULD DAVENPORT
Assistant Professor of Animal Science, B.S., University of Massachusetts; M.S., PH.D., Cornell University

CHARLES BINGHAM DAVEY
Associate Professor of Soil Science and Forestry, B.S., New York State College of Forestry; M.S., PH.D., University of Wisconsin

ADAM CLARKE DAVIS
Assistant Professor of Rural Sociology, B.S., University of North Carolina at Chapel Hill: M.S., North Carolina State of the U. of N. C. at Raleigh

ELMO LEE DAVIS
Driver Trainer, Division of General Extension, Driver Training School

HENRY MAUZEE DAVIS
Adjunct Professor of Metallurgical Engineering, B.S., M.S., University of Oklahoma; PH.D., University of Minnesota

JACK LEON DAVIS
Driver Trainer, Division of General Extension, Driver Training School

MOSES PAUL DAVIS
Research Assistant in Engineering Research, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

PHILLIP HARVEY DAVIS
Associate Professor of English, A.M., M.A., Miami University (Ohio)

WILLIAM ROBERT DAVIS
Associate Professor of Physics, B.S., M.S., University of Oklahoma; PH.D., University of Gottingen (Germany); DOKTOR DER NATURUISS, University of Hanover (Germany)

KEITH M. DeARMOND
Assistant Professor of Chemistry, B.S., Depauw University; PH.D., University of Arizona

ALBERT MAYNARD DEEKENS
Associated Publications Editor in Agricultural Information, B.S., Virginia Polytechnic Institute; M.S., Pennsylvania State University

THOMAS WEST DELLA
Instructor in Experimental Statistics and Mathematics, B.S., University of Richmond

STEPHEN WALLACE DERBYSHIRE
Research Associate in Engineering Research, B.S.CER.E., North Carolina State of the U. of N. C. at Raleigh

PAUL HAROLD DERR
Head of Department and Professòr of Physical Education, B.S., University of Illinois; M.A., New York University

JAMES WILLIAM DICKENS
Assistant Professor of Agricultural Engineering, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM DAVID DIEHL
Research Assistant in Agricultural Economics, B.S., Montana State College; M.S., North Carolina State of the U. of N. C. at Raleigh

EMMETT URCEY DILLARD
Associate Professor of Animal Science, B.S., Berea College; M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of Missouri

DANIEL ROBERT DIXON
Adjunct Professor of Economics, A.B., College of William and Mary; LL.B., Duke University; L.L.M., New York University

GEORGE OSMORE DOAK
Professor of Chemistry, B.S. *in Chemistry*, B.S. *in Pharmacy*, University of Saskatchewan; M.S. *in Pharmaceutical Chemistry*, PH.D., *in Pharmaceutical Chemistry and Pharmacology*, University of Wisconsin

WALTER JEROME DOBROGOSZ
Assistant Professor of Botany and Bacteriology, B.S., M.S., PH.D., Pennsylvania State University

SAMUEL HILL DOBSON
Extension Professor of Crop Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JOHN FRANK DOGGETT
Extension Assistant Professor of Soil Science, B.S., North Carolina State of the U. of N. C. at Raleigh

WESLEY OSBORNE DOGGETT
Assistant Dean of the School of Physical Sciences and Applied Mathematics and Professor of Physics, B.N.E., B.E.E., North Carolina State of the U. of N. C. at Raleigh; M.S., PH.D., University of California

ROBERT JOHN DOLAN
Associate Professor of Extension Education and Rural Sociology, B.S., M.S., PH.D., Louisiana State University

WILLIAM EMMERT DONALDSON
Associate Professor of Poultry Science, B.S., M.S., PH.D., University of Maryland

JESSE SEYMOUR DOOLITTLE
Professor of Mechanical Engineering, B.S., Tufts College; M.S., Pennsylvania State University; PROF. ENG.

ROBERT LYLE DOUGH
Assistant Professor of Physics, B.S., Guilford College; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

* ROBERT ALDEN DOUGLAS
Professor of Engineering Mechanics, B.S., M.S., PH.D., Purdue University

ROSS SWARENS DOUGLASS
Extension Assistant Professor of Forest Management, B.S., North Carolina State of the U. of N. C. at Raleigh; M.F., Duke University

LOUIS ARNOLD DOW
Assistant Professor of Economics, B.S., M.B.A., PH.D., Indiana University

MURRAY SCOTT DOWNS
Assistant Professor of History and Political Science, B.A., Randoph-Macon College; M.A., PH.D., Duke University

LAWRENCE WILLIAM DRABICK
Research Associate Professor of Agricultural Education and Rural Sociology, B.S., Pennsylvania State College; M.S., PH.D., University of Pennsylvania

DONALD WILLIAM DREWES
Assistant Professor of Psychology, B.S., Iowa State College; M.A., State University of Iowa; PH.D., Purdue University

ERNEST P. DRISCOLL
Assistant Football Coach, Athletics, B.S., North Carolina State of the U. of N. C. at Raleigh

JOHN W. DUDLEY
Research Associate Professor of Crop Science, B.S., Purdue University; M.S., PH.D., Iowa State College

---

* Leave of absence, July, 1964-July, 1966.

JOHN WARREN DUFFIELD
Professor of Silviculture, B.S., Cornell University; M.F., Harvard University; PH.D., University of California

GEORGE HEYWARD DUNLAP
Director of Textile Placement Bureau and Student Activities and Extension Professor of Textiles, B.S., Clemson College

PETER JOHN DYSON
Assistant Professor of Forest Management, B.S.A., Ontario Agricultural College; M.S.F., Montana State University; PH.D., North Carolina State of the U. of N. C. at Raleigh

FRED L. EARGLE
Industrial Specialist in Industrial Extension Service and Research Associate, B.S., North Carolina State of the U. of N. C. at Raleigh

JOHN BYNUM EASLEY
Assistant Professor of English, A.B., M.A., University of North Carolina at Chapel Hill

WILLIAM TAYLOR EASTER
Instructor in Electrical Engineering, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., Carnegie Institute of Technology

ARTHUR RAYMOND ECKELS
Professor of Electrical Engineering, B.S.E.E., University of Connecticut; M.S., Harvard University; D.ENGR., Yale University

BOBBY R. EDDLEMAN
Research Instructor in Agricultural Economics, B.S., Texas Technological School; M.S., North Carolina State of the U. of N. C. at Raleigh

PRESTON WILLIAM EDSALL
Head of Department and Professor of History and Political Science, B.S., New York University; M.A., PH.D., Princeton University

EARLE LARUE EDWARDS
Football Coach, Athletics, B.S., M.A., Pennsylvania State University

JENNINGS BRYAN EDWARDS, JR.
Associate Professor of Physical Education, B.S., North Carolina State of the U. of N. C. at Raleigh; M.A., University of North Carolina at Chapel Hill

JOHN AUERT EDWARDS
Associate Professor of Engineering Mechanics, B.S.M.E., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Purdue University

WILLIAM F. EDWARDS
Associate Professor of Social Studies, B.A., Amherst College; PH.D., Columbia University

FRED EICHENBERGER
Assistant Professor of Product Design, B.S., Pratt Institute

EUGENE J. EISEN
Assistant Professor of Animal Science, A.A.S., State University of New York; B.S., M.S., University of Georgia; PH.D., Purdue University

HERBERT GARFIELD ELDRIDGE, JR.
Associate Professor of English, A.B., M.A., PH.D., University of Pennsylvania

MAGDI MOHAMED EL-KAMMASH
Assistant Professor of Economics, B.COM., M.P.H., Cairo University (Egypt)

GERALD H. ELKAN
Associate Professor of Botany and Bacteriology, B.A., Brigham Young University; M.S., Pennsylvania State University; PH.D., Virginia Polytechnic Institute

THOMAS SMITH ELLEMAN
Associate Professor of Nuclear Engineering, B.S., Denison University; PH.D., Iowa State University

ROBERT NEAL ELLIOTT
Associate Professor of Social Studies, B.S., Appalachian State Teachers College; M.A., PH.D., University of North Carolina at Chapel Hill

DON EDWIN ELLIS
Head of Department and Professor of Plant Pathology, B.SC., B.A., Nebraska Central College; M.S., Louisiana State University; PH.D., University of North Carolina at Chapel Hill

GEORGE LELAND ELLIS
Instructor in Animal Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

HOWARD McDONALD ELLIS
Extension Professor of Agricultural Engineering, B.S., North Carolina State of the U. of N. C. at Raleigh

MUNIR RIDHA EL-SADEN
Associate Professor of Mechanical Engineering, B.S., University of Denver; M.S., PH.D., University of Michigan; PROF. ENG.

ERIC LOUIS ELLWOOD
Head of Department and Professor of Wood Science and Technology, B.S., M.S., University of Melbourne (Australia); PH.D., Yale University

JOHN FREDRICK ELY
Assistant Professor of Civil Engineering and Engineering Mechanics, B.S.C.E., Purdue University; M.S., PH.D., Northwestern University

DONALD ALLEN EMERY
Associate Professor of Crop Science, B.S., M.S., University of New Hampshire; PH.D., University of Wisconsin

CHARLES BENNETT ENGLAND
Instructor in Soil Science, B.S.A., University of Georgia; M.S., Pennsylvania State University

SAMUEL JACKSON McCULLOUGH ENGLAND
Assistant Statistician in Experimental Statistics, A.B., University of Texas; M.A., Ohio State University

NORMAN GILBERT ERIKSEN
Assistant Professor of Military Science, B.S., Virginia Polytechnic Institute

JOHN LINCOLN ETCHELLS
Professor of Food Science, B.S., M.S., PH.D., Michigan State University

ROBERT WINSTON ETHEREDGE, JR.
Adjunct Associate Professor of Agriculture, North Carolina State of the U. of N. C. at Raleigh

JAMES BRAINERD EVANS
Professor of Bacteriology, B.S., Houghton College; PH.D., Cornell University

RALPH EIGIL FADUM
Dean of the School of Engineering and Professor of Civil Engineering, B.S.C.E., University of Illinois; M.S.E., S.D., Harvard University; D.ENG., Purdue University, PROF. ENG.

EMOL ATWOOD FAILS
Professor of Economics, B.S., Southwestern Institute of Technology; M.A., PH.D., George Peabody College for Teachers

DAVID IRVING FAIRBANKS
Instructor in Electrical Engineering, B.E.E., Syracuse University; M.S., University of Buffalo

JOHN MAX FALTER
Extension Assistant Professor of Entomology, B.S., M.S., PH.D., University of Wisconsin

BERKWOOD FARMER
Research Instructor in Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JOHN CHRISTOPHER FARRELL
Instructor in History and Political Science, A.B., Yale University; M.A., University of Minnesota

MAURICE HIGH FARRIER
Research Associate Professor of Entomology and Forestry, B.S., M.S., Iowa State College; PH.D., North Carolina State of the U. of N. C. at Raleigh

JOHN CLYDE FERGUSON
Extension Associate Professor of Agricultural Engineering, B.S., North Carolina State of the U. of N. C. at Raleigh

JAMES K. FERRELL
Professor of Chemical Engineering, B.S., M.S., University of Missouri; PH.D., North Carolina State of the U. of N. C. at Raleigh

HUGH MARTIN FIELDS
Extension Assistant Professor of Zoology, B.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM THOMAS FIKE, JR.
Assistant Professor of Crop Science, B.S., M.S., Pennsylvania State University; PH.D., University of Minnesota

ALVA LEROY FINKNER
Adjunct Professor of Experimental Statistics, B.S., Colorado A. & M. College; M.S., Kansas State College; PH.D., North Carolina State of the U. of N. C. at Raleigh

ALMON SUTPHEN FISH, JR.
Assistant Professor of Horticultural Science, B.S., Bates College; M.S., Kansas State College; PH.D., University of California

CHARLES PAGE FISHER, JR.
Associate Professor of Civil Engineering, B.C.E., University of Virginia; S.M., Harvard University; PH.D., North Carolina State of the U. of N. C. at Raleigh; PROF. ENG.

JAMES WALTER FITTS
Professor of Soil Science, B.S., Nebraska State Teachers College; M.S., University of Nebraska; PH.D., Iowa State College

WALTER CURTIS FITZGERALD, JR.
Assistant Professor of Philosophy and Religion, B.S., Wake Forest College; B.D., Southern Baptist Theological Seminary

LIGON BROADUS FLYNN
Instructor in Architecture, B.S., North Carolina State of the U. of N. C. at Raleigh

HUGH RAYMOND FORDYCE
Assistant Director of Admissions, Student Affairs, B.S., M.A., West Virginia University

JULIAN MARK FORE
Professor of Agricultural Engineering, B.S., Virginia Polytechnic Institute; M.S., Purdue University

CHARLES IRVING FOSTER
Professor of Social Studies, B.A., Princeton University; M.A., Harvard University

ALVIN MARCUS FOUNTAIN
Professor of English, B.E., M.S., North Carolina State of the U. of N. C. at Raleigh; M.A., Columbia University; PH.D., George Peabody College for Teachers

ANNA CLYDE FRAKER
Research Associate in Engineering Research, B.S., Furman University; M.S., North Carolina State of the U. of N. C. at Raleigh

LEON DAVID FREEDMAN
Associate Professor of Chemistry, B.A., M.A., PH.D., Johns Hopkins University

DANIEL FROMM
Associate Professor of Food Science, B.S., M.S., PH.D., Pennsylvania State University

ALAN STUART GALBRAITH
Adjunct Professor of Mathematics, B.S., University of Alberta (Canada); M.S., PH.D., Harvard University

WILLIAM SYLVAN GALLER
Assistant Professor of Civil Engineering, B.S.CH.E., M.S., SAN.E., Illinois Institute of Technology; PH.D. Northwestern University

GENE JOHN GALLETTA
Associate Professor of Horticultural Science, B.S., University of Maryland; M.S., Rutgers University; PH.D., University of California

GERALD GARB
Associate Professor of Economics, B.S., University of Pennsylvania; M.A., PH.D., University of California

BERT HOWARD GARCIA, JR.
Associate Professor of Mechanical Engineering, B.S.M.E., M.S.M.E., Pennsylvania State University

MONROE EVANS GARDNER
Professor of Horticultural Science, B.S., Virginia Polytechnic Institute

HENRY WILBURN GARREN
Head of Department and Professor of Poultry Science, A.B., University of North Carolina at Chapel Hill; B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., PH.D., University of Maryland

MARTHA JOHNSON GARREN
Instructor in Mathematics, A.B., University of North Carolina at Chapel Hill

HOWARD REED GARRISS
Extension Professor of Plant Pathology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

LOUIS EDWIN GATES
Chemical Specialist in the Industrial Extension Service, B.S.E.CH., Georgia Institute of Technology

JOACHIM GAYLER
Visiting Research Assistant Professor in Textile Technology, DR.ING., Stuttgart-Reutlinger (Germany)

JAMES DALTON GEORGE
Extension Professor of Animal Science, B.S., Mississippi State University; M.S., North Carolina State of the U. of N. C. at Raleigh

DAN ULRICH GERSTEL
William Neal Reynolds Distinguished Professor of Crop Science, B.S., M.S., PH.D., University of California

FORREST WILLIAM GETZEN
Associate Professor of Chemistry, B.S., Virginia Military Institute, M.S., University of Kentucky; PH.D., Massachusetts Institute of Technology

JOHN HENDERSON GILBERT
Instructor in History and Political Science, A.B., Lambuth College; M.A., Vanderbilt University; PH.D., University of Virginia

WILLIAM BEST GILBERT
Associate Professor of Crop Science, B.S., Berea College; M.S., University of Kentucky; PH.D., North Carolina State of the U. of N. C. at Raleigh

ROBERT C. GILMORE
Research Instructor in Wood Science, B.S., Pennsylvania State University

EDWARD WALKER GLAZENER
Director of Instruction, School of Agriculture and Professor of Poultry Science, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., PH.D., University of Maryland

CHESTER E. GLEIT
Associate Professor of Chemistry, A.B., M.S., University of Chicago; PH.D., Massachusetts Institute of Technology

WILLIAM ALEXANDER GLENN
Adjunct Associate Professor of Industrial Engineering and Experimental Statistics, A.B., University of New Brunswick (Canada); M.S., PH.D., Virginia Polytechnic Institute

JOHN WOMBLE GLOVER
Extension Assistant Professor of Agricultural Engineering, B.S., North Carolina State of the U. of N. C. at Raleigh

JERZY E. GLOWCZEWSKI
Associate Professor of Architecture, DIPL., MASTER OF TECH. SCI.-ARCH., Warsaw Higher Engineering School (Poland)

MARVIN RALPH GODFREY
Instructor in Crop Science, B.S., North Carolina State of the U. of N. C. at Raleigh

ALFRED JOHN GOETZE
Associate Professor of Electrical Engineering, B.S.E.E., Drexel Institute of Technology; M.SC., North Carolina State of the U. of N. C. at Raleigh

JAY GOLDMAN
Professor of Industrial Engineering, B.S., Duke University; M.S., Michigan State University; D.SC., Washington University

EUGENE FRIZZELLE GOLDSTON
Assistant Professor of Soil Science, B.S., North Carolina State of the U. of N. C. at Raleigh

LEMUEL GOODE
Associate Professor of Animal Science, B.S., M.S., West Virginia University; PH.D., University of Florida

GUY VERNON GOODING
Adjunct Assistant Professor of Plant Pathology and Forest Management, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of California at Davis

DORSEY McPEAKE GOSSETT
Extension Assistant Professor of Crop Science, B.S., University of Tennessee; M.S., University of Illinois; PH.D., North Carolina State of the U. of N. C. at Raleigh

GILBERT GOTTLIEB
Adjunct Assistant Professor of Psychology, B.A., M.S., University of Miami; PH.D., Duke University

PERRY LINWOOD GRADY
Research Assistant in Textile Technology, B.S.E.E., North Carolina State of the U. of N. C. at Raleigh

ARNOLD H. E. GRANDAGE
Professor of Experimental Statistics, B.A., Lehigh University; PH.D., North Carolina State of the U. of N. C. at Raleigh

RALPH WELLER GREENLAW
Associate Professor of History and Political Science, A.B., Amherst College; M.A., PH.D., Princeton University

JOHN HAYES GREGORY
Instructor in Animal Science, B.A., M.S., North Carolina State of the U. of N. C. at Raleigh

MARGARET PFLUGE GREGORY
Associate Geneticist in Genetics, B.S., M.S., Florida State University; PH.D., University of Virginia

MAX EDWIN GREGORY
Extension Assistant Professor of Food Science, B.S., University of Tennessee; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

WALTON CARLYLE GREGORY
William Neal Reynolds Distinguished Professor of Crop Science, B.A., D.SC., Lynchburg College; M.A., PH.D., University of Virginia

CHARLES PEYTON GREYER
Assistant Director of Admissions and Registration, Student Affairs, B.S., Davidson College

HAZEL CORNELLIA GRIFFIN
Special Lecturer in English, A.B., Chowan College; M.S., North Carolina State of the U. of N. C. at Raleigh

DANIEL SWARTWOOD GROSCH
Professor of Genetics, B.S., Moravian College; M.S., Lehigh University; PH.D., University of Pennsylvania

HENRY DOUGLASS GROSS
Associate Professor of Crop Science, B.S., M.S., Rutgers University; PH.D., Iowa State University

ELLIOTT BROWN GROVER
Head of Department of Textile Technology and Abel C. Lineberger Professor of Yarn Processing, B.S., Massachusetts Institute of Technology

THOMAS HYMAN GUION
Associate Professor of Textile Chemistry, B.S., Davidson College; PH.D., University of North Carolina at Chapel Hill

GEORGE ALBERT GULLETTE
Head of Department and Professor of Social Studies, A.B., Harvard University; M.A., Vanderbilt University; PH.D., University of Michigan

BHUPENDER SINGH GUPTA
Research Instructor in Textile Technology, B.S., Technological Institute of Textiles (India); PH.D., Manchester College of Science and Technology (England)

EDWARD DEWITT GURLEY
Assistant Professor of Engineering Mechanics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of Illinois

FRANK EDWIN GUTHRIE
Assistant Dean of the Graduate School for Research and Professor of Entomology, B.S., University of Kentucky; M.S., PH.D., University of Illinois

GEORGE RICHARD GWYNN
Research Assistant Professor of Crop Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Iowa State University

FRANK ARLING HAASIS
Professor of Plant Pathology, B.S., University of California; PH.D., Cornell University

WILLIAM CULLEN HACKLER
Professor of Ceramic Engineering, B.CER.E., M.S.CER.E., Virginia Polytechnic Institute; PH.D., North Carolina State of the U. of N. C. at Raleigh

ROBERT JOHN HADER
Professor of Experimental Statistics, B.S., University of Chicago; PH.D., North Carolina State of the U. of N. C. at Raleigh

GEORGE LEIGH HALL
Director of Television, University of Virginia; North Carolina State of the U. of N. C. at Raleigh

JOHN LOVELL HALL
Assistant Professor of Crop Science, B.S., PH.D., North Carolina State of the U. of N. C. at Raleigh; M.A., University of North Carolina at Chapel Hill

RUTH BADGER HALL
Assistant Professor of Modern Languages, B.A., Oberlin College; M.A., University of North Carolina at Chapel Hill

MAX HALPEREN
Assistant Professor of English, B.S., City College of New York; M.A., PH.D., Florida State University

DAME SCOTT HAMBY
Burlington Mills Professor of Textile Technology, B.S., Alabama Polytechnic Institute

CHARLES HORACE HAMILTON
William Neal Reynolds Distinguished Professor of Rural Sociology, B.S., Southern Methodist University; M.S., Texas A. & M. College; PH.D., University of North Carolina at Chapel Hill

JOHN VALENTINE HAMME
Associate Professor of Ceramic Engineering, B.S.CER.E., M.S.MIN.I., PH.D., North Carolina State of the U. of N. C. at Raleigh

LEIGH HUGH HAMMOND
Extension Associate Professor of Agricultural Economics, B.S., Clemson College; M.S., University of Tennessee; PH.D., North Carolina State of the U. of N. C. at Raleigh

LEONARD ALBERT HAMPTON
Extension Instructor in Forest Management, B.S., University of Georgia

ROGER EUGENE HANES
Instructor in Soil Science, B.S., North Carolina State of the U. of N. C. at Raleigh

DONALD JOSEPH HANSEN
Assistant Professor of Mathematics, B.S., M.S., Southern Methodist University; PH.D., University of Texas

DURWIN M. HANSON
Head of Department and Professor of Industrial Education, B.S., M.S., PH.D., Iowa State College

KARL P. HANSON
Director of Freshman Engineering and Professor of Mechanical Engineering, B.S., University of Wisconsin; M.S., University of Michigan; PROF. ENG.

WARREN D. HANSON
Professor of Genetics, B.S., University of Minnesota; M.S., PH.D., Purdue University

JOHN J. HARDER
Assistant Professor of Industrial Engineering, DIPL. ING., Technische Hochschule—Berlin; DR. ING., Technische Hochschule—Hanover (Germany)

JAMES WALKER HARDIN
Associate Professor of Botany and Forestry, B.S., Florida Southern College; M.S., University of Tennessee; PH.D., University of Michigan

HARRY ALLEN HARGRAVE
Instructor in English, B.A., Vanderbilt University; M.A., George Peabody College for Teachers

REINARD HARKEMA
Professor of Zoology, A.B., Calvin College; PH.D., Duke University

SADIE JENKINS HARMON
Assistant Professor of English, A.B., B.M., Greensboro College; M.A., PH.D., University of North Carolina at Chapel Hill

CLEON WALLACE HARRELL, JR.
Associate Professor of Economics, B.S., M.A., University of Virginia

GEORGE OLIVER HARRELL
Assistant Professor of Mineral Industries, B.S.CER.E., M.S.CER.E., North Carolina State of the U. of N. C. at Raleigh

WALTER JOEL HARRINGTON
Professor of Mathematics, B.A., M.A., PH.D., Cornell University

HARWELL HAMILTON HARRIS
Professor of Architecture; Pomona College, Otis Art Institute

JAMES RAY HARRIS
Extension Professor of Poultry Science, D.V.M., Auburn University

JOHN HENRY HARRIS
Extension Professor of Horticultural Science, B.S., North Carolina State of the U. of N.C. at Raleigh

MARVIN M. HARRIS
Driver Trainer, Division of General Extension, Driver Training School

ROGER N. S. HARRIS
Research Instructor in Agricultural Economics, B.S., Wye College (England); M.S., North Carolina State of the U. of N. C. at Raleigh

ERNEST HARRISON
Research Assistant in Engineering Research, B.S., Millsaps College

CLARENCE A. HART
Research Associate Professor of Wood Technology, B.S., Virginia Polytechnic Institute; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

CLYDE WILLIAM HART
Assistant Director of Foundations, B.S., North Carolina State of the U. of N. C. at Raleigh

FRANKLIN DELANO HART
Assistant Professor in Mechanical Engineering, B.M.E., M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

JOHN REGINALD HART
Research Associate in Industrial Extension Service, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

LODWICK CHARLES HARTLEY
Head of Department and Professor of English, B.A., LITT.D., Furman University; M.A., Columbia University; PH.D., Princeton University

PAUL HENRY HARVEY
Head of Department and William Neal Reynolds Distinguished Professor of Crop Science, B.S., University of Nebraska; PH.D., Iowa State University

DEWEY G. HARWOOD
Extension Assistant Professor of Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

HASSAN AHMED HASSAN
Professor of Mechanical Engineering, B.S., University of London; M.S., PH.D., University of Illinois

FRANCIS JEFFERSON HASSLER
Head of Department and William Neal Reynolds Distinguished Professor of Agricultural Engineering, B.S., University of Missouri; M.S., PH.D., Michigan State University

WILLIAM WALTON HASSLER
Associate Professor of Zoology, B.S., M.S., Cornell University; PH.D., University of Tennessee

GERALD GORDON HAWKINS
Assistant Director of Student Activities, Student Affairs, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., Indiana University

STERLING NORMAN HAWKS, JR.
Extension Associate Professor of Crop Science, B.S., North Carolina State of the U. of N. C. at Raleigh

MARK D. HAWTHORNE
Instructor in English, B.S., Wake Forest College; M.A., PH.D., University of Florida

ARTHUR COURTNEY HAYES
Associate Professor of Textile Chemistry, PH.B., Brown University; M.S., North Carolina State of the U. of N. C. at Raleigh

DON WILLIAM HAYNE
Professor of Experimental Statistics, A.B., Kalamazoo College; M.A., PH.D., University of Michigan

FRANK LLOYD HAYNES, JR.
Professor of Horticultural Science, B.S., Alabama Polytechnic Institute; PH.D., Cornell University

RUSSELL M. HAYNIE
Director of Instruction, Driver Training School, B.S., College of William and Mary

RICHARD SHERMAN HEATON
Associate Director, College Union, B.S., St. Lawrence University

TEDDY THEODORE HEBERT
Professor of Plant Pathology, B.S., Southwestern Louisiana Institute; M.S., Louisiana State University; PH.D., North Carolina State of the U. of N. C. at Raleigh

LAWRENCE L. HEFFNER
Adjunct Associate Professor of Textile Chemistry, B.S., Johns Hopkins University

JOHN HENRY HEINBOCKEL
Instructor in Engineering Mechanics and Mathematics, B.S.N.E., North Carolina State of the U. of N. C. at Raleigh; M.S., Rensselaer Polytechnic Institute

WARREN ROBERT HENDERSON
Assistant Professor of Horticultural Science, B.S., University of New Hampshire; M.A., Harvard University; PH.D., Ohio State University

WILLIAM ROBERT HENDLEY
Assistant Professor of Economics, B.A., Yale University

WALTER ANTON HENDRICKS
Adjunct Professor of Experimental Statistics, A.B., M.A., George Washington University

WILLIAM RAY HENRY
Associate Professor of Agricultural Economics, B.S., M.S., University of Arkansas; PH.D., North Carolina State of the U. of N. C. at Raleigh

FORREST CLYDE HENTZ, JR.
Assistant Professor of Chemistry, B.S., Newberry College; M.A., PH.D., University of North Carolina at Chapel Hill

LAURENCE JAY HERBST
Assistant Professor of Experimental Statistics, B.S., University of Miami; M.S., Massachusetts Institute of Technology; PH.D., Harvard University

ROBERT TAYLOR HERBST
Adjunct Associate Professor of Mathematics, M.S., North Carolina State of the U. of N. C. at Raleigh; A.B., PH.D., Duke University

LUTHER RUSSELL HERMAN
Instructor in Electrical Engineering, B.S., Lenoir Rhyne College; M.S. North Carolina State of the U. of N. C. at Raleigh; PROF. ENG.

JOHN HERTZMAN
Assistant Professor of Design, B.S., Illinois Institute of Technology

FRANCIS EUGENE HESTER
Associate Professor of Zoology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Auburn University

WILLIAM NORWOOD HICKS
Head of Department and Professor of Philosophy and Religion, B.E., M.S., North Carolina State of the U. of N. C. at Raleigh; B.A., Duke University; M.A., Oberlin College

WILLIAM LAWRENCE HIGHFILL
Associate Professor of Philosophy and Religion, B.A., Wake Forest College; B.D., Southern Baptist Theological Seminary; PH.D., Duke University

CHARLES HORACE HILL
Professor of Poultry Science, B.S., Colorado State University; M.S., PH.D., Cornell University

EUGENE FREDRICK HILL
Instructor in Electrical Engineering, B.S., M.S., University of New Brunswick (Canada)

GARLAND K. HILLIARD
Instructor in Mechanical Engineering, B.S., North Carolina State of the U. of N. C. at Raleigh

THOMAS IRA HINES
Head of Department and Professor of Recreation and Park Administration, B.S., North Carolina State of the U. of N. C. at Raleigh; M.A., University of North Carolina at Chapel Hill

JUAN EDUARDO HISADA
Research Assistant in Textile Technology, B.S., North Carolina State of the U. of N. C. at Raleigh

ROBERT GRANT HITCHINGS
Associate Professor of Pulp and Paper Technology, B.S., New York State College of Forestry; M.S., Duke University

JOHN ROBERT HIX
Assistant Professor of Architecture, B.ARCH., Iowa State University; M.ARCH., University of Pennsylvania

GEORGE BURNHAM HOADLEY
Head of Department and Professor of Electrical Engineering, B.S., Swarthmore College; M.SC., D.SC., Massachusetts Institute of Technology

LAFLOYD HUESTON HOBBS
Extension Assistant Professor of Wood Science and Technology, B.S., North Carolina State of the U. of N. C. at Raleigh

THOMAS NEWTON HOBGOOD, JR.
Extension Assistant Professor of Rural Sociology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

ARTHUR MABON HOCH
Associate Professor of Physical Education, B.S., Wake Forest College; M.ED., University of North Carolina at Chapel Hill

CHARLES SASNETTE HODGES
Research Associate Professor of Plant Pathology and Forest Management, B.S., M.S., University of Idaho; PH.D., University of Georgia

ERNEST HODGSON
Associate Professor of Entomology, B.S., Kings College; University of Durham (England); PH.D., Oregon State University

EUGENE HOLLAHAN
Instructor in English, B.A., Memphis State University; M.A., University of Tennessee

ABRAHAM HOLTZMAN
Professor of History and Political Science, A.A., Los Angeles City College; B.A., M.A., University of California at Los Angeles; M.A., PH.D., Harvard University

HENRY ALFRED HOMME
Extension Associate Professor of Agricultural Economics, B.A., Augustana College; M.A., Michigan State University

RUTH BALL HONEYCUTT
Assistant Professor of Mathematics, A.B., Wellesley College; M.A., Duke University

WILLIAM CALVIN HOOD
Assistant Professor of Mineral Industries, A.B., University of Missouri; PH.D., Montana State University

JAFAR HOOMANI
Instructor in Mathematics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

DALE MAX HOOVER
Associate Professor of Agricultural Economics, B.S., M.S., Iowa State College; M.A., PH.D., University of Chicago

MAURICE W. HOOVER
Professor of Food Science, B.S.A., M.S., PH.D., University of Florida

JOHN WILLIAM HORN
Associate Professor of Civil Engineering, B.S.C.E., West Virginia University; M.S.C.E., Massachusetts Institute of Technology; PROF. ENG.

HORACE ROBERT HORTON
Assistant Professor of Chemistry, B.S., Missouri School of Mines and Metallurgy; M.S., PH.D., University of Missouri

DANIEL GOODMAN HORVITZ
Adjunct Professor of Experimental Statistics, B.S., Massachusetts State College; PH.D., Iowa State College

IVAN HOSTETLER
Head of Department and Professor of Industrial Arts, B.A., Bluffton College; M.A., Ohio State University; ED.D., University of Missouri

GLORIA KATHLEEN HOUSER
Serials Librarian, D. H. Hill Library, A.B., Duke University; B.S.L.S., University of North Carolina at Chapel Hill

JAMES DOUGLAS HOWDER
Head of Department and Professor of Air Science, B.A., A & M College of Texas

EZRA LEWIS HOWELL
Associate Professor of Agricultural Engineering, B.S., M.ED., North Carolina State of the U. of N. C. at Raleigh

BARNEY KUO-YEN HUANG
Assistant Professor of Agricultural Engineering, B.S., National Taiwan University (Formosa); M.S., University of Illinois

GEORGE ROSCOE HUGHES
Extension Instructor in Horticultural Science, B.S., North Carolina State of the U. of N. C. at Raleigh

ERVIN GRIGG HUMPHRIES
Assistant Professor of Agricultural Engineering, B.S., M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

MORADA ALICE HUNT
Lecturer in Economics, A.B., LL.B., University of North Carolina at Chapel Hill

ARVEL HATCH HUNTER
Visiting Associate Professor of Soil Science, B.S., Brigham Young University; M.SC., Ohio State University; PH.D., North Carolina State of the U. of N. C. at Raleigh

ELVAN EDWARD HUTCHISON
Research Assistant Professor of Textile Technology, B.S., Marietta College; M.S., Institute of Textile Technology (Charlottesville, Virginia)

WILLIAM THORNHILL HUXSTER
Extension Assistant Professor in Wood Products, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

PANG FENG HWANG
Research Associate in Agricultural Engineering, B.S., National Taiwan University (Formosa); M.S., North Carolina State of the U. of N. C. at Raleigh

GEORGE HYATT, JR.
Associate Director of Agricultural Extension Service and Professor of Animal Science, B.S., Michigan State College; M.S., Rutgers University; PH.D., University of Wisconsin

THEODORE MARTIN HYMAN
Assistant Professor of Agricultural Information, B.S., M.S., University of Wisconsin

LOREN ALBERT IHNEN
Assistant Professor of Agricultural Economics, B.S., M.S., University of Illinois; PH.D., Iowa State University

WILLIAM PRENTISS INGRAM, JR.
Assistant Professor of Chemistry, B.S., M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

MICHIO ITO
Research Associate in Botany and Bacteriology, B.S., Niigata University; M.S., PH.D., Nagoya University (Japan)

MAKOTO ITOH
Visiting Professor of Electrical Engineering and Mathematics, B.S., Hiroshima College of Education; M.S., Kyoto University; PH.D., Hiroshima University (Japan)

MERRILL DEE JACKSON
Instructor in Entomology, B.A., Marion College; M.S., Virginia Polytechnic Institute

WILLIAM ADDISON JACKSON
Professor of Soil Science, B.S., Cornell University; M.S., Purdue University; PH.D., North Carolina State of the U. of N. C. at Raleigh

HERMAN BROOKS JAMES
Dean of the School of Agriculture and Life Sciences and Professor of Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Duke University

EDMUND FREDERICK JANSEN, JR.
Research Instructor in Agricultural Economics, B.S., University of Illinois

BENJAMIN ANDERSON JAYNE
Professor of Wood Technology, A.A., Boise Junior College; B.S., University of Idaho; M.F., D.FOR., Yale University

JOHN MITCHELL JENKINS, JR.
Research Professor of Horticultural Science, B.S., Clemson College; M.S., Louisiana State University; PH.D., University of Minnesota

HARLEY YOUNG JENNINGS
Visiting Research Professor of Textile Chemistry, B.S., Adrian College; M.S., PH.D., University of Michigan

RICHARD LEE JEWETT
Associate Professor in Industrial Extension Service, B.S., United States Military Academy, West Point; M.S., State University of Iowa; DIPL., Industrial College of the Armed Forces

CHIA REN JIN
Research Assistant in Textile Chemistry, B.S., National Taiwan University (Formosa); B.S., Auburn University; M.S., North Carolina State of the U. of N. C. at Raleigh

KINGSTON JOHNS
Assistant Director of Counseling, Student Affairs, B.A., Guilford College; B.A., Franklin and Marshall College; M.A., PH.D., Cornell University

CAROL HOLMES JOHNSON
Craft Shop Director, College Union, B.S., North Carolina State of the U. of N. C. at Raleigh

ELMER HUBERT JOHNSON
Professor of Sociology and Anthropology, B.A., M.A., PH.D., University of Wisconsin

JOHN MILTON JOHNSON
Assistant Reference Librarian, D. H. Hill Library, A.B., M.S., M.S.L.S., University of North Carolina at Chapel Hill

JOSEPH CLYDE JOHNSON
Associate Professor of Psychology, B.S., State Teachers' College (Troy, Alabama); M.A., ED.D., George Peabody College for Teachers

PAUL REYNOLDS JOHNSON
Research Associate Professor of Agricultural Economics, A.B., Oberlin College; M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of Chicago

WILLIAM HUGH JOHNSON
Assistant Professor of Agricultural Engineering, B.S., M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

BRUCE GILBERT JOHNSTON
Visiting Lecturer in Engineering Research, B.S.C.E., University of Illinois; M.S.C.E., Lehigh University; PH.D., Columbia University

WILLIAM RODGERS JOHNSTON
Instructor in Chemistry, B.S., M.S., University of North Carolina at Chapel Hill

ROBERT LAWRENCE JOHNSTONE
Extension Associate Professor of Agricultural Economics, B.S., M.S., University of Kentucky; PH.D., University of Illinois

EDGAR WALTON JONES
Extension Assistant Professor of Agricultural Economics, B.S., M.S., Clemson College; PH.D., North Carolina State of the U. of N. C. at Raleigh

EDWARD McCUTCHEN JONES
Extension Assistant Professor of Forestry, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., Louisiana Polytechnic Institute

GEORGE DENVER JONES
Extension Professor of Entomology, B.A., M.S., University of Missouri

GUY LANGSTON JONES
Professor of Crop Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of Minnesota

IVAN DUNLAVY JONES
Professor of Food Science, A.B., Nebraska Wesleyan University; PH.D., University of Minnesota

JAMES ROBERT JONES
Extension Asistant Professor of Animal Science, B.S., M.S., University of Kentucky; PH.D., Cornell University

JOHN CARLTON JONES
Extension Associate Professor of Forestry, B.S., North Carolina State of the U. of N. C. at Raleigh; M.F., Duke University

LOUIS ALLMAN JONES
Associate Professor of Chemistry, B.A., M.A., Clark University; PH.D., Texas A & M College

MARION LUTHER JONES
Extension Assistant Professor of Poultry Science, B.S., Clemson College; M.S., Oklahoma State University; PH.D., A & M College of Texas

VICTOR A. JONES
Assistant Professor of Food Science, B.S., M.S., PH.D., Michigan State University

KENNETH ALLAN JORDAN
Associate Professor of Agricultural Engineering, B.S., M.S., PH.D., Purdue University

LEON TYSOR JORDAN
Instructor in Mineral Industries, B.S., M.S., North Carolina State of the U. of N.C. at Raleigh

POORAN CHANDRA JOSHI
Research Associate in Botany and Bacteriology, B.S., M.S., PH.D., Naini Tal and University of Dehli (India)

CHARLES H. KAHN
Associate Professor of Architecture, A.B., University of North Carolina at Chapel Hill; M.S.STRUC., Massachusetts Institute of Technology; B.C.E., B.ARCH., North Carolina State of the U. of N. C. at Raleigh; PROF. ENG.

JOSEPH STEPHAN KAHN
Assistant Professor of Botany, B.S., University of California; PH.D., University of Illinois

HENRY LEVEKE KAMPHOEFNER
Dean of the School of Design and Professor of Architecture, B.S.ARCH., University of Illinois; M.S.ARCH., Columbia University

EUGENE JOHN KAMPRATH
Professor of Soil Science, B.S., M.S., University of Nebraska; PH.D., North Carolina State of the U. of N. C. at Raleigh

JOHN THOMAS KANIPE, JR.
Supervisor of Residence Counselors, Student Affairs, B.S., M.A., North Carolina State of the U. of N. C. at Raleigh

JOHN ALBERT KAPPELMAN
Instructor in Crop Science, B.S., Iowa State College; M.S., University of Nebraska; PH.D., North Carolina State of the U. of N. C. at Raleigh

MORLEY RICHARD KARE
Professor of Poultry Science and Zoology, B.S.A., University of Manitoba (Canada); M.S.A., University of British Columbia; PH.D., Cornell University

ABDEL-AZIZ ISMAIL KASHEF
Visiting Lecturer in Engineering Research, B.S., M.S., Cairo University (Egypt), PH.D., Purdue University

GERALD HOWARD KATZIN
Assistant Professor of Physics, B.S., M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

HAROLD KEATING
Associate Professor of Physical Education, B.S., M.ED., Springfield College

DONALD SPRING KEENER
Circulation Librarian, D. H. Hill Library, B.S., Xavier University; M.S., M.S.L.S., Western Reserve University

KENNETH RAYMOND KELLER
Assistant Director of Research in Charge of Tobacco and Professor of Crop Science, B.S., South Dakota University; M.S., PH.D., Iowa State University

WALTER McCLELLAN KELLER
Extension Professor of Forestry, B.S., North Carolina State of the U. of N. C. at Raleigh; M.F., Duke University

JACK KELLEY
Extension Professor of Animal Science, B.S., M.S., University of Kentucky

ROBERT CLAY KELLISON
Liaison Geneticist in Forest Management, B.S., West Virginia University; M.S., North Carolina State of the U. of N. C. at Raleigh

HARRY C. KELLY
Dean of the Faculty and Professor of Physics, B.S., Lehigh University; M.S., PH.D., Massachusetts Institute of Technology

JOSEPH WHEELER KELLY
Professor of Poultry Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Iowa State University

ARTHUR KELMAN
William Neal Reynolds Distinguished Professor of Plant Pathology and Professor of Forest Management, B.S., Rhode Island State College; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

JOHN FAWCETT KENFIELD, JR.
Associate Professor of Physical Education, B.A., M.A., University of North Carolina at Chapel Hill

JOE MASON KENYON, JR.
Research Assistant in Crop Science, B.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM EUGENE KEPPLER, JR.
Extension Professor of Wood Products, B.S., Pennsylvania State College

DAVID BERT KESTERSON
Instructor in English, B.S.E., Southwest Missouri State College; M.A., University of Arkansas

HENDERSON GRADY KINCHELOE
Professor of English, B.A., University of Richmond; M.A., Harvard University; PH.D., Duke University

CYRUS BALDWIN KING
Acquisition Librarian, D. H. Hill Library, A.B., University of North Carolina at Chapel Hill; M.A., University of Kentucky

JAMES AUSTIN KING, JR.
Research Instructor in Textile Technology, B.S., Clemson College

*RICHARD ADAMS KING
M. G. Mann Distinguished Professor of Agricultural Economics, B.S., University of Connecticut; M.S., University of California; M.P.A., PH.D., Harvard University

ROSA DEANS KIRBY
Instructor in Textile Chemistry, B.A., Meredith College

---

* Leave of absence, January, 1964-July, 1965.

JAMES BRYANT KIRKLAND
Dean of the School of Education and Professor of Agricultural Education, B.S.AG., M.S., University of Tennessee; PH.D., Ohio State University

STEDMAN KITCHIN, JR.
Instructor in Modern Languages, B.A., Wake Forest College; M.A., University of Alabama

JAMES WARNER KLIBBE
Academic Coordinator and Assistant Professor of Textiles, B.S., North Carolina State of the U. of N. C. at Raleigh

DAVID McKENDREE KLINE
Research Associate Professor of Plant Pathology, A.B., M.A., University of Virginia; PH.D., University of Wisconsin

GLENN CHARLES KLINGMAN
Professor of Crop Science, B.S., University of Nebraska; M.S., Kansas State University; PH.D., Rutgers University

HERBERT ALLAN KNAPPENBERGER
Instructor in Industrial Engineering, B.S., M.S.I.E., Pennsylvania State University

GEORGE FRANKLIN KNIGHT
Instructor in Mathematics, B.S., University of South Carolina; M.A., University of Detroit

RICHARD BENNETT KNIGHT
Professor of Mechanical Engineering, B.S., University of Maryland; M.S., University of Illinois; PROF. ENG.

FRED NELSON KNOTT
Extension Assistant Professor of Animal Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

ALBERT SIDNEY KNOWLES
Assistant Professor of English, B.A., M.A., University of Virginia

KWANGIL KOH
Instructor in Mathematics, B.S., M.S., Auburn University

KEN-ICHI KOJIMA
Professor of Genetics, B.S., M.S., Kyoto University (Japan); PH.D., North Carolina State of the U. of N. C. at Raleigh

CHARLES FREDERICK KOLB
Assistant Professor of History and Political Science, B.A., Drury College, M.A., University of Kentucky

MELVIN HENRY KOLBE
Extension Professor of Horticultural Science, B.S., Ohio State University; M.S., West Virginia University

THOMAS RHINEHART KONSLER
Assistant Professor of Horticultural Science, B.S., University of Kentucky; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

BENJAMIN GRANADE KOONCE, JR.
Associate Professor of English, A.B., M.A., University of North Carolina at Chapel Hill; PH.D., Princeton University

JOHN CLEMENT KOOP
Visiting Associate Professor of Experimental Statistics, B.S., University College, Rangoon (Burma); PH.D., North Carolina State of the U. of N. C. at Raleigh

WILLIAM WURTH KRIEGEL
Head of Department and Professor of Ceramic Engineering, B.S.C.E., B.S.CER.E., University of Washington; M.S., Montana School of Mines; DR. ING., Technische Hochshule (Germany); PROF. ENG.

GANGARAM K. KRIPALANI
Research Instructor in Agricultural Economics, D.G., National College, Hyderabad Sind (India); D.I.J., Sind College, Karachi; M.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM KURYLO
Instructor in Philosophy and Religion, B.SC., Rutgers University; B.A., Oberlin College

LEATON JOHN KUSHMAN
Associate Professor of Horticultural Science, B.S., M.S., George Washington University

ROBERT WALTER LADE
Assistant Professor of Electrical Engineering, B.S., Marquette University; M.S., PH.D., Carnegie Institute of Technology

JOHN RALPH LAMBERT, JR.
Professor of Social Studies, A.B., Western Maryland College; M.A., PH.D., Princeton University

ELEANOR HEINZ LAMMI
Counselor, Student Affairs, A.B., University of California

JOE OSCAR LAMMI
Professor of Forest Management, B.S., M.S., Oregon State College; PH.D., University of California

FORREST WESLEY LANCASTER
Professor of Physics, B.S.CH.E., M.S., Purdue University; PH.D., Duke University

JOE E. LAND, JR.
Assistant Professor of Military Science, B.S., Clemson College

CHESTER GREY LANDES
Assistant Professor of Pulp and Paper Technology, B.S.CH.E., Ohio State University

JAMES HENRY LANE
Instructor in Civil Engineering, B.S., Duke University; M.S., North Carolina State of the U. of N. C. at Raleigh

LEONARD JAY LANGFELDER
Assistant Professor of Civil Engineering, B.C.E., M.S.E., University of Florida; PH.D., University of Illinois

ROY AXEL LARSON
Assistant Professor of Horticultural Science, B.S., M.S., University of Minnesota; PH.D., Cornell University

LOUIE THOMAS LASSITER
Assistant Professor of Textile Technology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JAMES EDWARD LAWSON
Assistant Professor of Military Science, B.S., Mercer University

JAMES MURRAY LEATHERWOOD
Assistant Professor of Animal Science, B.S., Berea College; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

JAMES GIACOMO LECCE
Professor of Animal Science, B.A., Dartmouth College; M.S., Pennsylvania State University; PH.D., University of Pennsylvania

THOMAS BENSON LEDBETTER
Assistant Professor of Mechanical Engineering, B.M.E., M.S., North Carolina State of the U. of N. C. at Raleigh

JOSHUA ALEXANDER LEE
Associate Professor of Crop Science, A.B., San Diego State College; PH.D., University of California

SUNG WON LEE
Research Instructor in Textile Technology, B.S., Alabama Polytechnic Institute; M.S., North Carolina State of the U. of N. C. at Raleigh

JAMES EDWARD LEGATES
William Neal Reynolds Distinguished Professor of Animal Science and Head, Animal Breeding Section, B.S., University of Delaware; M.S., PH.D., Iowa State University

EDWARD CHARLES LEHMAN, JR.
Assistant Professor of Sociology and Anthropology, A.B., Mississippi State College; M.A., PH.D., Mississippi State University; B.DIV., Southeastern Seminary

CARLTON JAMES LEITH
Associate Professor of Geological Engineering, B.A., M.A., University of Wisconsin; PH.D., University of California

BOBBY EUGENE LEONARD
Instructor and Research Associate in Nuclear Reactor Project, B.S.C.E.C., M.S.M.E., North Carolina State of the U. of N. C. at Raleigh

RALPH A. LEONARD
Research Instructor in Soil Science, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., Purdue University

WILLIAM RUSSELL LEONHARDT
Assistant Professor of Physical Education, B.S., Springfield College; M.S., University of Illinois

JACK LEVINE
Professor of Mathematics, B.A., University of California; PH.D., Princeton University

CHARLES SANFORD LEVINGS, III
Research Assistant in Crop Science, B.S., M.S., PH.D., University of Illinois

CHARLES FREDERICK LEWIS
Assistant Professor of Mathematics., B.S., Tennessee State College; M.A., George Peabody College for Teachers

ROBERT M. LEWIS
Mineral Dressing Engineer, Mineral Research, B.S., West Virginia University

WILLIAM MASON LEWIS
Associate Professor of Crop Science, B.S., Texas A & M College; M.S., PH.D., University of Minnesota

PETER PUN-DUEN LI
Research Instructor in Textile Technology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

HERBERT MELVIN LIEBERSTEIN
Visiting Professor of Mathematics, B.S., B.A., University of Arkansas; M.S., University of Kansas; PH.D., University of Maryland

ERWIN EUGENE LIEBHAFSKY
Visiting Professor of Agricultural Economics, B.S., M.S., Texas A & M College; PH.D., University of Illinois

THOMAS CARL LIND
Instructor in Textile Technology, B.S., North Carolina State of the U. of N. C. at Raleigh

MARTHA FOY LINEBERRY
Head Catalog Librarian, D. H. Hill Library, A.B., Meredith College; A.B.L.S., University of North Carolina at Chapel Hill

HUGH L. LINER
Extension Instructor in Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

DAVID ALLEN LINK
Assistant Professor of Agricultural Engineering, B.S., Cornell University; M.S., PH.D., Iowa State University

* CHARLES HOWIE LITTLE, JR.
Assistant Professor of Mathematics, B.A., Davidson College; M.A., University of North Carolina at Chapel Hill

JAMES HENRY LITTLE, IV
Assistant Professor of Physical Education, B.E., Central Michigan College of Education; M.A., University of Michigan

ISAAC THOMAS LITTLETON
Assistant Director, D. H. Hill Library, A.B., University of North Carolina at Chapel Hill; M.A., University of Tennessee; M.S.L.S., University of Illinois

CHARLES DWAINE LIVENGOOD
Research Assistant in Textile Chemistry, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

ROBERT WARREN LLEWELLYN
Professor of Industrial Engineering, B.S.E.E., Union College; M.S.I.E., Purdue University

RICHARD HENRY LOEPPERT
Professor of Chemistry, B.S., Northwestern University; PH.D., University of Minnesota

---

* Leave of absence, February, 1964-June, 1965.

G. GILBERT LONG
Associate Professor of Chemistry, B.A., Indiana University; M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of Florida

ROBERT WILBURN LONG
Extension Assistant Professor of Rural Sociology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JOSEPH WILLIAM LOVE
Extension Assistant Professor of Horticultural Science, B.S., Louisiana State University; M.S., PH.D., Ohio State University

ROY LEE LOVVORN
Director of Research for the School of Agriculture and Professor of Crop Science, B.S., Auburn University; M.S., University of Missouri; PH.D., University of Wisconsin

RONE PATRICK LOWE
Assistant Editor, Agricultural Information, A.B., University of North Carolina at Chapel Hill

ROBERT E. LUBOW
Assistant Professor of Psychology and Zoology, B.A., New York University; M.S., Washington State University; PH.D., Cornell University

GEORGE BLANCHARD LUCAS
Professor of Plant Pathology, B.S., Pennsylvania State College; M.S., PH.D., Louisiana State University

HENRY LAWRENCE LUCAS, JR.
William Neal Reynolds Distinguished Professor of Experimental Statistics, B.S., University of California; PH.D., Cornell University

ARTHUR EDWARD LUCIER
Research Associate in Engineering Research, B.CER.E., M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

JAMES FULTON LUTZ
Professor of Soil Science, B.S., North Carolina State of the U. of N. C. at Raleigh; M.A., PH.D., University of Missouri

WALTER KENNETH LYNCH
Research Associate in Textile Technology, B.S., North Carolina State of the U. of N. C. at Raleigh

JOSEPH THOMAS LYNN
Administrative Assistant and Associate Professor of Physics, B.A., Vanderbilt University; M.S., Ohio State University

HARRYE BLACK LYONS
School of Design Librarian, D. H. Hill Library, B.A., Iowa University; M.A., IN L.S., University of Denver

ROBERT ARCHIBALD MACKERRACHER
Assistant Professor of Mathematics, GRAD., United States Naval Academy; M.A., University of Virginia

JOHN A. MACON
Chemical Engineer in Industrial Extension Service, B.S., North Carolina State of the U. of N. C. at Raleigh

CLARENCE J. MADAY
Assistant Professor of Engineering Mechanics, B.S., M.S., Illinois Institute of Technology; PH.D., Northwestern University

JAMES GRAY MADDOX
Professor of Agricultural Economics, B.S., University of Arkansas; M.S., University of Wisconsin; M.P.A., PH.D., Harvard University

ALEXANDER RUSSELL MAIN
Associate Professor of Entomology, A.B., M.A., Queen's University (Canada); PH.D., Cambridge University (England)

T. EWALD MAKI
Head of Department and Carl Alwin Schenck Distinguished Professor of Forest Management, B.S., M.S., PH.D., University of Minnesota

OWEN MALLER
Visiting Assistant Professor of Zoology, M.A., Southern Methodist University; B.S., PH.D., University of Illinois

ALBERT L. MALPASS
Assistant Professor of Air Science, B.S., Sacramento State College

ARMSTRONG MALTBIE
Assistant Professor of Mathematics, B.S., University of Vermont

EDWARD RAYMOND MANRING
Professor of Physics, B.S., M.S., PH.D., Ohio State University

CARROLL LAMB MANN, JR.
Campus Planner and Professor of Civil Engineering, B.S.C.E., North Carolina State of the U. of N. C. at Raleigh; C.E., Princeton University; PROF. ENG.

THURSTON JEFFERSON MANN
Head of Department of Genetics and Professor of Crop Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Cornell University

EDWARD GEORGE MANNING
Associate Professor of Electrical Engineering, B.S.E.E., Lehigh University; M.S., North Carolina State of the U. of N. C. at Raleigh; PROF. ENG.

ELIZABETH HINES MANNING
Instructor in Chemistry, A.B., University of North Carolina at Greensboro

PRESS MARAVICH
Assistant Basketball Coach, Athletics, B.A., B.S., Davis and Elkins College; M.S., West Virginia University

JOE ALTON MARLIN
Instructor in Mathematics, B.S., Southeast Missouri State College; M.A., University of Missouri

CULPEPPER PAUL MARSH
Extension Associate Professor of Rural Sociology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

HENRY VANCE MARSHALL, JR.
Research Assistant in Botany and Bacteriology, B.S., North Carolina State of the U. of N. C. at Raleigh

DAVID BOYD MARSLAND
Associate Professor of Chemical Engineering, B.CH.E., PH.D., Cornell University

CARTER WILLIAMS MARTIN
Assistant Professor of English, A.B., Presbyterian College; M.A., Vanderbilt University

CLIFFORD K. MARTIN
Extension Assistant Professor of Soil Science, B.S., M.S., University of Kentucky; PH.D., University of Illinois

DAVID HAMILTON MARTIN
Assistant Professor of Physics, B.S., Presbyterian College; M.S., University of Wisconsin

DONALD CROWELL MARTIN
Assistant Professor of Chemical Engineering, B.S., M.S., University of South Carolina

GRADY ALLEN MARTIN
Assistant Professor of Poultry Science, BS.., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Purdue University

LEROY BROWN MARTIN, JR.
Assistant Professor of Mathematics, B.S., Wake Forest College; M.S., North Carolina State of the U. of N. C. at Raleigh; M.S., PH.D., Harvard University

WILLIAM ROYAL MARTIN, JR.
Adjunct Assistant Professor of Textile Chemistry, A.B., M.B.A., University of North Carolina at Chapel Hill; B.S., North Carolina State of the U. of N. C. at Raleigh

BERNARD S. MARTOF
Head of Department and Professor of Zoology, B.S., Waynesburg College; M.S., West Virginia University; PH.D., University of Michigan

DAVID DICKENSON MASON
Head of Department and Professor of Experimental Statistics, B.A., King College; M.S., Virginia Polytechnic Institute; PH.D., North Carolina State of the U. of N. C. at Raleigh

JAMES IREDELL MASON
Assistant Director of the Division of General Extension, A.B., University of North Carolina at Chapel Hill

FRANCES W. HORTON MASSEY
Instructor in Textile Technology, B.S., East Carolina College; M.A., University of North Carolina at Greensboro

GENNARD MATRONE
William Neal Reynolds Distinguished Professor of Animal Science, B.S., M.S., Cornell University; PH.D., North Carolina State of the U. of N. C. at Raleigh

JOSEPH CARSON MATTHEWS, JR.
Research Instructor in Agricultural Economics, B.S. IN CHEM., B.S. IN AG.EC., M.S., North Carolina State of the U. of N. C. at Raleigh

DALE F. MATZINGER
Professor of Genetics, B.S., M.S., PH.D., Iowa State College

JACKSON R. MAUNEY
Research Associate Professor of Crop Science, B.S., Iowa State University; M.S., PH.D., University of Wisconsin

SELZ CABOT MAYO
Head of Departments of Sociology and Anthropology and Rural Sociology and Professor of Rural Sociology, A.B., Atlantic Christian College; M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of North Carolina at Chapel Hill

DONALD VAN McCALISTER
Assistant Professor of Sociology and Anthropology, A.B., Fresno State College; PH.D., University of Tennessee

GLENN CROCKER McCANN
Associate Professor of Rural Sociology, B.A., M.A., University of Colorado; PH.D., Washington State College

CHARLES BERNARD McCANTS
Professor of Soil Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Iowa State College

GEORGE EDWARD McCELVEY
Instructor in English, A.B., Rice University; M.A., University of Houston

WILLIAM FRED McCLURE
Instructor in Agricultural Engineering, B.S., Clemson College; M.S., North Carolina State of the U. of N. C. at Raleigh

* ROBERT EDMUND McCOLLUM
Assistant Professor of Soil Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of Illinois

CLARENCE LESLIE McCOMBS
Research Professor of Horticultural Science, B.S., M.S., PH.D., Ohio State University

RALPH JOSEPH McCRACKEN
Head of Department and Professor of Soil Science, A.B., Earlham College; M.S., Cornell University; PH.D., Iowa State College

HILLIARD B. McCULLOUGH
Assistant to the Athletics Department

W. T. McDANIEL, JR.
Chief Engineer in Minerals Research, B.S., University of North Carolina at Chapel Hill

DONALD McDONALD
Assistant Professor of Civil Engineering, B.C.E., Auburn University; M.S., PH.D., University of Illinois; FROF. ENG.

HUGH DALLAS McDONALD
Instructor in Civil Engineering, B.S.C.E., Campbell College; M.S.C.E., North Carolina State of the U. of N. C. at Raleigh

LEE ROY McDONALD
Assistant Social Director, College Union, B.S., East Carolina College

---

* Leave of absence, June, 1963-May, 1965.

PATRICK HILL McDONALD, JR.
Head of Department and Professor of Engineering Mechanics, B.S.ENGR., North Carolina State of the U. of N. C. at Raleigh; M.S., PH.D., Northwestern University

ROBERT LEE McELWEE
Research Instructor in Forest Genetics, B.S.F., West Virginia University; M.S., North Carolina State of the U. of N. C. at Raleigh

AC RUBLE McGALLIARD
Assistant Reference Librarian, D. H. Hill Library, A.B., Davis and Elkins College; B.S.L.S., University of North Carolina at Chapel Hill

JOHN CLARENCE McGEE
Instructor in Chemical Engineering, B.S., M.S., West Virginia University

ROBERT LEE McGUIRE
Extension Assistant Professor of Animal Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

FOIL WILLIAM McLAUGHLIN
Acting Director, North Carolina Crop Improvement Association, and Associate Professor of Crop Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JOHN JOSEPH McNEILL
Assistant Professor of Animal Science, B.S., M.S., PH.D., University of Maryland

FRANCIS EDWARD McVAY
Professor of Experimental Statistics, B.S., University of Rhode Island; M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of North Carolina at Chapel Hill

JULIE G. McVAY
Instructor in Mathematics, B.A., Antioch College

JEFFERSON SULLIVAN MEARES
Professor of Physics, B.S., University of South Carolina; M.S., North Carolina State of the U. of N. C. at Raleigh

JASPER DURHAM MEMORY
Associate Professor of Physics, B.S., Wake Forest College; PH.D., University of North Carolina at Chapel Hill

ARTHUR CLAYTON MENIUS, JR.
Dean of the School of Physical Sciences and Applied Mathematics and Professor of Physics, B.A., Catawba College; PH.D., University of North Carolina at Chapel Hill

PAUL RICHARD MEOSKY
Instructor in Industrial Arts, B.S., M.A., West Virginia University

LAWRENCE EUGENE METTLER
Associate Professor of Genetics and Zoology, A.B., Miami University; M.S., University of Kentucky; PH.D., University of Texas

ROBERT S. METZGER
Associate Professor of Social Studies, B.A., University of Wisconsin; M.A., PH.D., Columbia University

ALBERT P. MICHAELS
Assistant Foo.ball Coach, Athletics

GORDON KENNEDY MIDDLETON
Professor of Crop Science, B.S., North Carolina State of the U. of N. C. at Raleigh; B.S., PH.D., Cornell University

HENRY MOORE MIDDLETON, JR.
Assistant Professor of Knitting Technology, B.S., North Carolina State of the U. of N. C. at Raleigh

JOSEPH LEONARD MIDDLETON
Associate Professor of Philosophy and Religion, B.A., Wake Forest College; B.D., Crozer Theological Seminary; M.A., Columbia University

MARION L. MILES
Assistant Professor of Chemistry, B.S., M.S., University of Georgia; PH.D., University of Florida

ROBERT DONALD MILHOLLAND
Extension and Research Assistant Professor of Plant Pathology, B.S., M.S., Oklahoma State University; PH.D., University of Minnesota

CONRAD HENRY MILLER
Associate Professor of Horticultural Science, B.S., M.S., Virginia Polytechnic Institute; PH.D., Michigan State College

DARRELL ALVIN MILLER
Assistant Professor of Crop Science, B.S., M.S., University of Illinois; PH.D., Purdue University

GROVER CLEVELAND MILLER
Associate Professor of Zoology, A.B., Berea College; M.S., University of Kentucky; PH.D., Louisiana State University

HOWARD GEORGE MILLER
Head of Department and Professor of Psychology, B.S., New York State College for Teachers; M.A., Ohio State University; PH.D., Pennsylvania State University

JULIA B. MILLER
Women's Counselor in Counseling Department, Student Affairs, A.B., University of Michigan

LATHAM L. MILLER
Associate Professor of Recreation and Park Administration, B.A., Wake Forest College; M.A., University of North Carolina at Chapel Hill

NORMAN C. MILLER, JR.
Extension Assistant Professor of Food Science, B.S., M.S., Pennsylvania State University

PHILIP ARTHUR MILLER
Professor of Crop Science, B.S., M.S., University of Nebraska; PH.D., Iowa State College

RAYMOND JARVIS MILLER
Assistant Professor of Soil Science, B.S., University of Alberta (Canada); M.S., Washington State University; PH.D., Purdue University

TEXTON ROBERT MILLER
Assistant Professor of Agricultural Education, B.S., M.A., Michigan State University; PH.D., Ohio State University

WILLIAM CLEARON MILLS
Extension Associate Professor of Poultry Science, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., PH.D., Michigan State University

WALTER JOSEPH MISTRIC, JR.
Associate Professor of Entomology, B.S., Louisiana State University; M.S., PH.D., A & M College of Texas

ADOLPHUS MITCHELL
Professor of Engineering Mechanics, B.S.C.E., M.S.C.E., University of North Carolina at Chapel Hill; PROF. ENG.

RICHARD DOUGLAS MOCHRIE
Associate Professor of Animal Science, B.S., M.A., University of Connecticut; PH.D., North Carolina State of the U. of N. C. at Raleigh

CARL ALBERT MOELLER
Assistant Professor of Industrial Arts, B.A., Michigan State University; M.ED., A & M College of Texas; ED.D., Wayne State University

ROBERT HARRY MOLL
Associate Professor of Genetics, B.S., Cornell University; M.S., University of Idaho; PH.D., North Carolina State of the U. of N. C. at Raleigh

DANIEL JAMES MONCOL
Assistant Professor of Animal Science, B.S., Virginia Polytechnic Institute; D.V.M., University of Georgia

ROBERT JAMES MONROE
Professor of Experimental Statistics, B.S., Iowa State College; PH.D., University of North Carolina at Chapel Hill

SEUNG GYU MOON
Visiting Assistant Professor of Rural Sociology, B.S., M.S., Chonpuk University (Korea); PH.D., North Carolina State of the U. of N. C. at Raleigh

FRANK HARPER MOORE
Associate Professor of English, A.B., University of Florida; M.A., PH.D., University of North Carolina at Chapel Hill

HARRY BALLARD MOORE, JR.
Instructor in Entomology, B.S., East Carolina College; M.S., Purdue University

JAMES LeGRAND MOORE
Assistant Professor of Animal Science, B.S.CH., Hampden-Sydney College; B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

RICHARD ALAN MOORE
Head of Department and Associate Professor of Landscape Architecture, B.S., University of Missouri; M.L.A., University of Oregon

ROBERT PARKER MOORE
Research Professor of Crop Science, B.S., Oklahoma State University; M.S., Iowa State University; PH.D., Ohio State University

CHARLES GALLOWAY MOREHEAD
Associate Professor of Occupational Information and Guidance, A.B., Hendrix College; M.A., Duke University; ED.M., ED.D., University of Kansas

CHARLES GLEN MORELAND
Assistant Professor of Chemistry, B.S., M.S., PH.D., University of Florida

DONALD EDWIN MORELAND
Associate Professor of Crop Science, B.S., M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

JOHN WESLEY MORGAN
Instructor in Chemistry, A.B., M.A., Duke University

MAIDRED JOYCE MORRIS
Home Economics Editor, Agricultural Information, B.S., East Carolina College

THOMAS BUIE MORRIS
Extension Associate Professor of Poultry Science, B.S.A., M.S.A., University of Georgia

WILLIAM EDWIN MOSER
Associate Professor of Textile Technology, B.S., North Carolina State of the U. of N. C. at Raleigh

JAMES HAROLD MOSES
Instructor in Recreation in the Division of General Extension, B.A., University of North Carolina at Chapel Hill

CLAUDE W. MOSS
Research Associate in Food Science, B.S., M.S. North Carolina State of the U. of N. C. at Raleigh

MARVIN KENT MOSS
Assistant Professor of Physics, A.B., Elon College; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

DARL ALLEN MOUNT
Instructor in Entomology, B.S., Oklahoma State University

SAMUEL EDWARD MOYER
Assistant Geneticist in Genetics, B.S., Pennsylvania State University; M.S., University of New Hampshire; PH.D., University of Minnesota

ROY WALTON MOZINGO
Research Assistant in Crop Science, B.S., North Carolina State of the U. of N. C. at Raleigh

HARLEY L. MUDGE, JR.
Technical Analyst in Industrial Extension Service, B.S., North Carolina State of the U. of N. C. at Raleigh

CAREY GARDNER MUMFORD
Professor of Mathematics, B.A., Wake Forest College; M.A., PH.D., Duke University

W. RAY MURLEY
Profesor of Animal Science, B.S., M.S., PH.D., Iowa State College

CHARLES FRANKLIN MURPHY
Assistant Professor of Crop Science, B.S., Iowa State University; M.S., Purdue University; PH.D., Iowa State University

FRANK JUNIOR MURRAY
Assistant Professor of Physical Education, B.A., M.A., University of North Carolina at Chapel Hill

RAYMOND LEROY MURRAY
Head of Department of Nuclear Engineering and Burlington Professor of Physics, B.S., M.A., University of Nebraska; PH.D., University of Tennessee

RAYMOND W. MUSSELWHITE
Assistant Professor of Architecture, B.S., University of Georgia

GUY ARNOLD MYERS
Instructor in Engineering Mechanics, B.S. M.E., M.S.E.M., North Carolina State of the U. of N. C. at Raleigh

RICHARD MONIER MYERS
Assistant Professor of Animal Science, B.S., M.S., Pennsylvania State College

HOWARD M. NAHIKIAN
Professor of Mathematics, B.A., M.A., PH.D., University of North Carolina at Chapel Hill

GENE NAMKOONG
Research Assistant Professor of Genetics and Forest Management, B.S., M.S., State University of New York; PH.D., North Carolina State of the U. of N. C. at Raleigh

WALLACE KING NAVE
Extension Instructor in Agricultural Economics, B.S., North Carolina State of the U. of N. C. at Raleigh

GEORGE FISK NEEDHAM, III
Assistant Director of Counseling Department, Student Affairs, A.B., Western Maryland College; M.ED., Harvard University

LARRY ALAN NELSON
Assistant Professor of Experimental Statistics, B.S., Iowa State University; M.S., A & M College of Texas; PH.D., North Carolina State of the U. of N. C. at Raleigh

RICHARD ROBERT NELSON
Professor of Plant Pathology, B.A., Augsburg College; M.S., PH.D., University of Minnesota

JOSEPH TAFT NERDEN
Professor of Industrial Education, B.S., Central Connecticut State College; M.A., PH.D., Yale University

DUANE FREDRICK NEUMAN
Assistant Professor of Agricultural Economics, B.S., University of Nebraska; M.S., PH.D., University of Illinois

HERBERT HENRY NEUNZIG
Associate Professor of Entomology, B.S., M.S., PH.D., Cornell University

SLATER EDMUND NEWMAN
Professor of Psychology, B.S., University of Pennsylvania; M.A., Boston University; PH.D., Northwestern University

THOMAS EVERETT NICHOLS, JR.
Extension Associate Professor of Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM COLVIN NICHOLS
Instructor in Architecture, B.ARCH., North Carolina State of the U. of N. C. at Raleigh

LOWELL WENDELL NIELSEN
Professor of Plant Pathology, B.S., M.S., Utah State Agricultural College; PH.D., Cornell University

CHITTARANJAN NARANDAS NIRMEL
Instructor in Engineering Mechanics, B.SC., (ENG.), Battersea College of Advanced Technology (England); M.S.M.E., North Carolina State of the U. of N. C. at Raleigh

JOHN WAYNE NIXON
Research Assistant in Agricultural Economics, B.S., Berea College; M.S., North Carolina State of the U. of N. C. at Raleigh

EVELYN B. NOBLIN
Assistant Catalog Librarian, D. H. Hill Library, A.B., Chowan College; A.B., A.B.L.S., University of North Carolina at Chapel Hill

STUART McGUIRE NOBLIN
Professor of History and Political Science, A.B., Davidson College; A.M., PH.D., University of North Carolina at Chapel Hill

GLENN RAY NOGGLE
Head of Department and Professor of Botany and Bacteriology, A.B., Miami University (Ohio); M.S., PH.D., University of Illinois

ARNOLD NOLSTAD
Associate Professor of Mathematics, B.A., Luther College; M.A., PH.D., University of Pittsburgh

ALBERT L. NORTON
Assistant Professor of Military Science, B.S., Virginia Polytechnic Institute

JANE UMSTEAD NORWOOD
Extension Instructor in Rural Sociology, B.S., University of North Carolina at Greensboro

CHARLES JOSEPH NUSBAUM
William Neal Reynolds Distinguished Professor of Plant Pathology, B.S., Oregon State College; M.S., PH.D., University of Wisconsin

BILLY LYNN NUTTER
Instructor in Physical Education, A.B., Hendrix College; M.S.E., Arkansas State Teachers College

PHARES STEVENS NYE
Instructor in Engineering Graphics, B.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM LEE O'BRIEN
Instructor in Agriculture, B.S., North Carolina State of the U. of N. C. at Raleigh

KENNETH SMITH OLESON
Assistant Professor of Industrial Education, B.S., M.S., Iowa State University

GEORGE MOTLEY OLIVER
Instructor in Chemistry, A.B., M.S., University of North Carolina at Chapel Hill

BERNARD MARTIN OLSEN
Professor of Economics, A.B., M.A., PH.D., University of Chicago

ADRIANA PANNEVIS ORR
Librarian, School of Textiles Library, A.B., Elmira College; M.S.L.S., University of North Carolina at Chapel Hill

OLIVER HAMILTON ORR, JR.
Assistant Professor of History and Political Science, A.B., PH.D., University of North Carolina at Chapel Hill

ERNEST GLENN OVERTON
Assistant Director for Registration, Student Affairs, B.A., Wofford College; M.A., East Carolina College

GUY OWEN
Associate Professor of English, B.A., M.A., PH.D., University of North Carolina at Chapel Hill

HUBERT LOWELL OWEN
Instructor in Physics, B.S., Wake Forest College

MEHMET M. OZISIK
Associate Professor of Mechanical Engineering, B.S., PH.D., University of London (England)

EDWIN HUGH PAGET
Associate Professor of English, B.L., Northwestern University; M.A., University of Pittsburgh

HAYNE PALMOUR, III
Research Associate Professor of Ceramic Engineering in Engineering Research, B.CER.E., M.S., Georgia Institute of Technology; PH.D., North Carolina State of the U. of N. C. at Raleigh

DON CARSON PARDUE
Extension Instructor in Animal Science and Agricultural Economics, B.S., Berea College

JAMES EDWIN PARDUE
Associate Professor of Textile Technology, B.S., North Carolina State of the U. of N. C. at Raleigh

RAMESH JETHAL PAREKH
Instructor in Mechanical Engineering, B.S., L.D., College of Engineering (India); M.S., North Carolina State of the U. of N. C. at Raleigh

HUBERT VERN PARK
Administrative Assistant in the Department of Mathematics and Professor of Mathematics, B.A., Lenoir Rhyne College; M.A., PH.D., University of North Carolina at Chapel Hill

JAE YOUNG PARK
Assistant Professor of Physics, B.S., Seoul National University (Korea); M.S., Rennsselaer Polytechnic Institute; PH.D., University of North Carolina at Chapel Hill

GEORGE WILLIAM PARKER
Instructor in Physics, B.A., University of the South

JOHN MASON PARKER, III
Professor of Geological Engineering, B.A., M.A., PH.D., Cornell University

GUY SHERIDAN PARSONS
Extension Associate Professor of Animal Science, B.S., M.S., West Virginia University

ERNEST CALEB PASOUR, JR.
Assistant Professor of Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Michigan State University

DONALD DEAN PATE
Assistant Professor of Poultry Science, M.S., D.V.M., A. & M. College of Texas

HAROLD EDWARD PATTEE
Assistant Professor of Botany and Bacteriology, B.S., Brigham Young University; M.S., Utah State University; PH.D., Purdue University

JAMES WILLIAM PATTERSON
Extension Associate Professor of Animal Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

CARLOTTA PETERSON PATTON
Instructor in Mathematics, B.S., College of Charleston

RICHARD ROLAND PATTY
Assistant Professor of Physics, B.S., Furman University; M.A., Vanderbilt University; PH.D., Ohio State University

LALJI JAYANHLAL PAVAGADHI
Instructor in Mechanical Engineering, B.S., Morvi Engineering College (India); M.S., North Carolina State of the U. of N. C. at Raleigh

HOWARD DOUBERLEY PEARCE
Instructor in English, B.A., M.A., University of Florida

RALPH JAMES PEELER, JR.
Assistant Professor of Agricultural Economics, B.S., M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

ASTOR PERRY
Extension Associate Professor of Crop Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JEROME JOHN PERRY
Assistant Professor in Botany and Bacteriology, B.S., Pennsylvania University; PH.D., University of Texas

PAUL WILLARD PERRY
Instructor in Forest Management, B.S., Pennsylvania State University

THOMAS OLIVER PERRY
Associate Professor of Forest Genetics, B.S., M.A., PH.D., Harvard University

LEE HOMER PERSON
Research Associate Professor of Plant Pathology, B.S., Mississippi State College; M.S., PH.D., University of Minnesota

ROGER GENE PETERSEN
Associate Professor of Experimental Statistics, B.S., M.S., Iowa State University; PH.D., North Carolina State of the U. of N. C. at Raleigh

DANIEL McLEOD PETERSON
Associate Professor of Mathematics, B.A., University of Mississippi; M.A., Duke University

WALTER JOHN PETERSON
Dean of the Graduate School and William Neal Reynolds Distinguished Professor of Chemistry, B.S.M.S., Michigan State College; PH.D., University of Iowa

WILBUR CARROLL PETERSON
Associate Professor of Electrical Engineering, B.S.E.E., University of Minnesota; M.S., Michigan State University; PH.D., Northwestern University; PROF. ENG.

HOWARD ALDRIDGE PETREA
Associate Professor of Mathematics, B.S., Guilford College; M.A., University of North Carolina at Chapel Hill

DAVID WEBSTER PHILLIPS
Social Director, College Union, B.S., North Carolina State of the U. of N. C. at Raleigh

LYLE LLEWELLYN PHILLIPS
Professor of Crop Science, B.A., University of Redlands; M.A., Claremont College; PH.D., University of Washington

ROBERT LINCOLN PHILLIPS
Assistant Professor of Landscape Architecture, B.L.A., North Carolina State of the U. of N. C. at Raleigh; M.L.A., Harvard University

WALTER HENRY PIERCE
Professor of Agricultural Economics, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., PH.D., University of Minnesota

JAMES RODNEY PILAND
Research Associate Professor of Soil Science, B.S., Wake Forest College; M.S., North Carolina State of the U. of N. C. at Raleigh

RICHARD COLEMAN PINKERTON
Associate Professor of Chemistry, B.S., M.S., Michigan State University; PH.D., Iowa State University

ROBERT McLEAN PINKERTON
Professor of Aeronautical Engineering, B.S., Bradley University

LARRY E. PLASTER
Assistant Professor of Air Science, B.S., Davidson College

EMMA WILDER POHL
Reference Librarian, D. H. Hill Library, A.B., Randoph-Macon Woman's College; B.S.L.S., University of North Carolina at Chapel Hill

GEORGE WAVERLY POLAND
Head of Department and Professor of Modern Languages, B.A., College of William and Mary; M.A., Brown University; PH.D., University of North Carolina at Chapel Hill; DIPL., University de Salamanca

MARY ELIZABETH POOLE
Documents Librarian, D. H. Hill Library, A.B., Duke University; B.S.L.S., University of North Carolina at Chapel Hill

CHANDRA JOSHI POORAN
Research Associate in Botany and Bacteriology, B.S., M.S., PH.D., Naini Tal and University of Delhi (India)

DANIEL TOWNSEND POPE
Research Professor of Horticultural Science, B.S., Clemson College; M.S., Louisiana State University; PH.D., Cornell University

JACK PORTER
Assistant Professor of English, A.B., George Peabody College for Teachers; M.A., University of North Carolina at Chapel Hill; PH.D., University of Denver

JOSEPH ALEXANDER PORTER, JR.
Professor of Textile Technology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

IRA DEWARD PORTERFIELD
Head of Department and Professor of Animal Science, B.S., University of Maryland; M.S., West Virginia University; PH.D., University of Minnesota

LAURENCE ERNEST POTEAT
Instructor in Metallurgical Engineering, B.M.E., North Carolina State of the U. of N. C. at Raleigh; M.S., Stanford University; PROF. ENG.

NATHANIEL THOMAS POWELL
Associate Professor of Plant Pathology, B.S., Virginia Polytechnic Institute; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

ANCO LUNING PRAK
Instructor in Industrial Engineering, Technische Hochschule (Delft, The Netherlands)

RICHARD JOSEPH PRESTON
Dean of the School of Forestry and Professor of Forestry, B.A., M.S.F., PH.D., University of Michigan

VIRGINIA MEADE PRICHARD
Instructor in Modern Languages, B.A., College of William and Mary; M.A., Duke University

WALTER RAY PRINCE
Research Associate in Poultry Science, B.S., M.S., University of Kentucky

CHARLES HARRY PROCTOR
Associate Professor of Experimental Statistics, B.A., M.A., PH.D., Michigan State University

EDWIN ALLEN PROCTOR
Extension Associate Professor of Agricultural Economics, B.S., M.S., University of Kentucky

JESSE ALLAN PROCTOR
Trainer, Athletics, B.A., Wake Forest College

THOMAS GILMER PROCTOR, III
Instructor in Mathematics, B.N.E., M.S., North Carolina State of the U. of N. C. at Raleigh

CHARLES RAY PUGH
Extension Associate Professor of Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Purdue University

ALBERT ERNEST PURCELL
Associate Professor of Food Science, B.S., Brigham Young University; M.S., PH.D., Purdue University

THOMAS LAVELLE QUAY
Professor of Zoology, B.S., University of Arkansas; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

JOHN WILLIAM QUERRY
Associate Professor of Mathematics, B.S., Northwest Missouri State College; M.S., PH.D., State University of Iowa

EMILY H. QUINN
Extension Associate Professor of Agricultural Education, Agricultural Extension Service, B.S., Georgia State College for Women; M.S., PH.D., University of Wisconsin

KENNETH DALE RAAB
Director of Admissions and Registration Department, A.B., University of Illinois; M.A., University of California

ROBERT LAMAR RABB
Professor of Entomology, B.S., M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

ALLEN HUFF RAKES
Assistant Professor of Animal Science, B.S., M.S., Virginia Polytechnic Institute; PH.D., Cornell University

HAROLD ARCH RAMSEY
Professor of Animal Science, B.S., Kansas State College; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

JOHN OREN RAWLINGS
Associate Professor of Experimental Statistics, B.S., M.S., University of Nebraska; PH.D., North Carolina State of the U. of N. C. at Raleigh

HORACE DARR RAWLS
Associate Professor of Sociology and Anthropology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Duke University

IMMO H. REDEKER
Ore Dressing Engineer in Minerals Research Laboratory, Professional Degree, University for Mining and Metallurgy (Australia); M.S., Columbia University

GOODWYN GEORGE REEVES
Instructor in Electrical Engineering, S.B. IN ELEC. ENGR., Massachusetts Institute of Technology

DAVID W. REID
Instructor in Experimental Statistics, B.S., North Carolina State of the U. of N. C. at Raleigh

ELBERT REID
Assistant Professor of Agricultural Information, B.S., M.A., Louisiana State University

PRESTON HARDING REID
Associate Professor of Soil Science, B.S., Colorado A & M College; B.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

WILLIAM WALTON REID
Extension Instructor in Horticultural Science, B.S., North Carolina State of the U. of N. C. at Raleigh

WILLIS ALTON REID
Professor of Chemistry, B.S., Wake Forest College; PH.D., University of Wisconsin

HAL LEACH REYNOLDS
Assistant Extension Editor, Agricultural Information, B.S., North Carolina State of the U. of N. C. at Raleigh

MAX STEVE RHODES
Instructor in Physical Education, B.S., M.A., Western Carolina College

JAMES THOMAS RICE
Assistant Professor in Wood Technology, B.S., Alabama Polytechnic Institute; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

JOHN CARL RICE
Director of N. C. Crop Improvement Association and Professor of Crop Science, B.S., M.S., Alabama Polytechnic Institute; PH.D., Mississippi State University

THEODORE R. RICE
Adjunct Professor of Zoology, A.B., Berea College; M.A., PH.D., Harvard University

NANCY BAILEY RICH
Instructor in English, A.B., M.A., University of North Carolina at Chapel Hill

RAYMOND RAY RICH
Extension Assistant Professor of Animal Science, B.S., North Carolina State of the U. of N. C. at Raleigh

FRANCES MARIAN RICHARDSON
Research Associate Professor of Engineering Research, B.S., Roanoke College; M.S., University of Cincinnati

JACKSON ASHCROFT RIGNEY
Director of N. C. Agricultural Mission to Peru and Professor of Experimental Statistics, B.S., New Mexico State College; M.S., Iowa State College

ALLAN WENDELL RINNE
Technical Analyst in Industrial Extension Service, B.S., University of Washington

RAY MILLER RITCHIE, JR.
Extension Associate Professor of Agricultural Engineering, B.S., Virginia Polytechnic Institute; PROF. ENG.

ERWIN FRANK RITTER
Instructor in Modern Languages, A.B., M.A., Marquette University

JERRY ALLAN ROBERTS
Instructor in Mathematics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

LEONARD ROBERTS
Adjunct Professor of Applied Mathematics, B.SC., M.SC., PH.D., University of Manchester (England)

WILLIAM MILNER ROBERTS
Head of Department and Professor of Food Science, B.S.A., University of Tennessee; M.S., PH.D., University of Minnesota

ROBERT LaFON ROBERTSON
Extension Associate Professor of Entomology, B.S., M.S., Auburn University

COWIN COOK ROBINSON
Professor of Chemistry, B.A., Sterling College; M.A., University of Kansas; PH.D., University of Wisconsin

HAROLD FRANK ROBINSON
Director of the Institute of Biological Sciences and Assistant Director of Instruction of Agricultural Experiment Station, and Professor of Genetics, B.S., M.S., North Caro- State of the U. of N. C. at Raleigh; PH.D., University of Nebraska

MENDEL LENO ROBINSON, JR.
Instructor in Textile Research, B.S., North Carolina State of the N. of N. C. at Raleigh

ROBERT ALAN ROBINSON
Assistant Professor of Air Science, B.S., East Carolina College

ODIS WAYNE ROBISON
Assistant Professor of Animal Science, B.S., Oklahoma A & M College; M.S., PH.D., University of Wisconsin

CHARLES HERMAN ROGERS
Assistant Professor of Agricultural Education, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

LYLE BARTON ROGERS
Director of Counseling Department, Student Affairs, B.A., Dakota Wesleyan University; M.S., PH.D., Columbia University

CHARLES AUGUST ROHDE
Assistant Professor of Experimental Statistics, B.S., Case Institute of Technology; PH.D., North Carolina State of the U. of N. C. at Raleigh

JOHN PAUL ROSS
Research Associate Professor of Plant Pathology, B.S., University of Vermont; PH.D., Cornell University

CARL SIDNEY RUDISILL
Instructor in Mechanical Engineering, B.S.M.E., M.S.M.E., North Carolina State of the U. of N. C. at Raleigh

EDWARD WOLFE RUGGLES
Director of Division of General Extension, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

DONALD JACOB RULFS
Associate Professor of English, B.A., PH.D., University of North Carolina at Chapel Hill; M.A., Harvard University

PAUL JAMES RUST
Associate Professor of Psychology, B.A., M.A., University of Idaho; PH.D., University of Washington

HENRY AMES RUTHERFORD
Head of Department and Professor of Textile Chemistry, B.S., Davis and Elkins College; M.A., George Washington University

HANS SAGAN
Professor of Mathematics, PH.D., University of Vienna (Austria)

PHILIP NEAL SALES
Chemical Engineer in Engineering Research, B.S.C.E., North Carolina State of the U. of N. C. at Raleigh

ROBERT REED SANDERLIN
Instructor in English, B.S., M.A., Memphis State University

GORDON STUART SANFORD
Research Instructor in Agricultural Economics, B.S., M.S., University of Connecticut

JOHN ANTHONY SANTOLUCITO
Associate Professor of Zoology, A.B., University of California at Berkeley; PH.D., University of California at Davis

FRANK DORRANCE SARGENT
Extension Instructor in Animal Science, B.S., University of New Hampshire; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

JOSEPH NEAL SASSER
Professor of Plant Pathology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of Maryland

ICHIRO SATO
Research Associate in Botany and Bacteriology, B.S., Tokyo University (Japan)

ROBERT G. SAVAGE
Instructor in Mathematics, B.S., M.S., University of Florida

RAYMOND FREDERICK SAXE
Visiting Professor of Nuclear Engineering, B.SC., University of London; PH.D., University of Liverpool (England)

LEROY CHARLES SAYLOR
Assistant Professor of Genetics, B.S., Iowa State College; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

CLARENCE CAYCE SCARBOROUGH
Chairman, Division of Teacher Education and Head of Department and Professor of Agricultural Education, B.S., M.S., Alabama Polytechnic Institute; ED.M., ED.D., University of Illinois

JOACHIM-DIETRICH SCHOBEL
Visiting Research Associate Professor of Engineering Research, DIPLOMA-ING., Technische Hochschule, Aachen; DR.ING., Technische Hochschule, Stuttgart (Germany)

EDWARD MARTIN SCHOENBORN, JR.
Head of Department and Professor of Chemical Engineering, B.CH.E., M.S., PH.D., Ohio State University; PROF. ENG.

RONALD ARTHUR SCHRIMPER
Instructor in Agricultural Economics, B.S., M.S., Pennsylvania State University

WILFRED M. SCHUTZ
Research Assistant Professor of Genetics, B.S., M.S., University of Nebraska; PH.D., North Carolina State of the U. of N. C. at Raleigh

HERBERT TEMPLE SCOFIELD
Professor of Botany, A.B., PH.D. Cornell University

GARLAND ELMO SCOTT
Research Assistant in Engineering Research, B.S., North Carolina State of the U. of N. C. at Raleigh

JAMES ARTHUR SEAGRAVES
Associate Professor of Agricultural Economics, A.B., Reed College; M.S., PH.D., Iowa State College

WAYLAND PRITCHARD SEAGRAVES
Assistant Professor of Electrical Engineering, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

WOODROW HARMON SEARS, JR.
Assistant Extension Editor, Agricultural Information, A.B., University of North Carolina at Chapel Hill

LOUIS WALTER SEEGERS
Professor of History and Political Science, B.A., Muhlenberg College; M.A., University of Pennsylvania

JOHN FRANK SEELY
Associate Professor of Chemical Engineering, B.CH.E., M.CH.E., North Carolina State of the U. of N. C. at Raleigh

FRANK L. SELMAN
Instructor in Crop Science, B.S., M.S., Auburn University

HEINZ SELTMANN
Research Assistant Professor of Botany and Bacteriology, B.A., Drew University; M.S., PH.D., University of Chicago

MARVIN EUGENE SENGER
Extension Professor of Animal Science, B.S., Iowa State College; M.S., University of Maryland

PETER SHAHDAN
Assistant Professor of Mathematics, PH.B., Brown University; M.S., North Carolina State of the U. of N. C. at Raleigh

ROBERTA SHEILA SHAIN
Instructor in Modern Languages, A.B., Hunter College; M.A., Pennsylvania State University

ARTHUR T. SHANKLE
Instructor in Electrical Engineering, B.A., B.S.E.E., Louisiana State University; M.E.E., North Carolina State of the U. of N. C. at Raleigh

HENRY ANTHONY SHANNON
Assistant Professor of Science Education, B.S., Appalachian State Teachers' College; ED.M., University of Missouri

GRAYE JOHNSON SHAW
Instructor in Chemistry, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

LUTHER SHAW
Associate Professor of Crop Science, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., University of Arkansas; PH.D., University of Wisconsin

BRIAN SHAWCROFT
Associate Professor of Architecture, DIPLOMA OF ARCH., Southwest Essex Technical College and School of Art (England); M.ARCH., Massachusetts Institute of Technology

WILFRED MICHAEL SHEA
Assistant Professor of Physical Education, B.S., North Carolina State of the U. of N. C. at Raleigh; M.E., University of North Carolina at Chapel Hill

ROBERT JEROME SHELDON
Assistant Professor of Air Science, B.B.A., University of Cincinnati; M.S., San Francisco State College

ALFRED BERNARD ROWLAND SHELLEY
Associate Professor of English, B.S., Tufts College; M.A., Harvard University

JAMES EDWARD SHELTON
Assistant Professor of Soil Science, B.S., M.S., University of Kentucky; PH.D., North Carolina State of the U. of N. C. at Raleigh

ROBERT TINSLEY SHERWOOD
Research Associate Professor of Plant Pathology, B.S., M.S., Cornell University; PH.D., University of Wisconsin

PAULINUS SHEE-SHAN SHIEH
Instructor in Physics, B.S., National Taiwan University (Formosa); M.S., University of South Carolina

MAYNARD EARL SHIELDS
Assistant Professor of Military Science, B.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM EDWARD SHINN
Head of Department and Chester H. Roth Professor of Knitting Technology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

ROBERT WORTH SHOFFNER
Director of Foundations and Development, B.S., North Carolina State of the U. of N. C. at Raleigh

VERNON FREDERICK SHOGREN
Assistant Professor of Architecture, B.ARCH., University of Minnesota; M.ARCH., Massachuetts Institute of Technology

JOHN BARR SHULER
Assistant Professor of Civil Engineering, B.S.C.E., University of South Carolina; PROF. ENG.

RICHARD LEE SIMMONS
Associate Professor of Agricultural Economics, B.S., M.S., Kansas State College; PH.D., University of California

SOFUS EMMELOV SIMONSEN
Instructor in Modern Languages, TEA.CERT., Teachers College of Arhus; B.S., University of Arhus (Denmark)

WILLIAM HUGHES SIMPSON
Assistant to the Dean of the Faculty, B.S., Wake Forest College; M.A., Columbia University

EDWARD CARROLL SISLER
Associate Professor of Chemistry and Crop Science, B.S., M.S., University of Maryland; PH.D., North Carolina State of the U. of N. C. at Raleigh

BENJAMIN J. SLOAN
Instructor in Engineering Research, B.S.E.E., M.E.E., North Carolina State of the U. of N. C. at Raleigh

FREDERICK SILER SLOAN
Extension Professor in Agricultural Extension Service, B.S., North Carolina State of the U. of N. C. at Raleigh

HOWARD GORDON SMALL
Extension Assistant Professor of Crop Science, B.S.M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Purdue University

CHARLES SMALLWOOD, JR.
Professor of Civil Engineering, B.S.SAN.E., Case Institute of Technology; M.S., Harvard University; PROF. ENG.

ELIZABETH ANN SMALTZ
Instructor in Physical Education, B.S., Pennsylvania State University

WILLIAM R. SMALTZ
Assistant Football Coach, Athletics

WILLIAM WESLEY GARRY SMART, JR.
Research Associate Professor of Animal Science and Experimental Statistics, B.S., Clemson College; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

FREDERICK OTTO SMETANA
Associate Professor of Mechanical Engineering, B.M.E., M.S.M.E., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of Southern California

THOMAS BRYAN SMILEY
Instructor in Electrical Engineering, B.S., M.S., University of North Carolina at Chapel Hill

BENJAMIN WARFIELD SMITH
Professor of Genetics, B.A., M.A., University of Virginia; PH.D., University of Wisconsin

CLYDE FUHRIMAN SMITH
Professor of Entomology, B.S., M.S., Utah Agricultural College; PH.D., Ohio State University

EDWARD HOLMAN SMITH
Head of Department and Professor of Entomology, B.S., Clemson College; M.S., PH.D., Cornell University

FARMER STERLING SMITH
Assistant Professor of Industrial Education, B.S., North Carolina State of the U. of N. C. at Raleigh; M.A., University of North Carolina at Chapel Hill

FRANK HOUSTON SMITH
Professor of Animal Science, B.S., Davidson College; M.S., North Carolina State of the U. of N. C. at Raleigh

GEORGE WATSON SMITH
Associate Director of North Carolina Agricultural Extension Service and Extension Professor of Forestry, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

* NORWOOD GRAHAM SMITH
Assistant Professor of English, A.B., M.A., Duke University

WILLIAM EDWARD SMITH
Professor of Physical Education, B.S., Western Carolina Teachers' College; M.A., University of North Carolina at Chapel Hill; ED.D., George Peabody College for Teachers

WILLIAM EDWARD SMITH
Research Assistant Professor of Textile Technology, B.S., North Carolina State of the U. of N. C. at Raleigh

RONALD ERNEST SNEED
Extension Instructor in Agricultural Engineering, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

A. C. SNOW
Special Lecturer in Liberal Arts, A.B., University of North Carolina at Chapel Hill

* Leave of absence, July 1964-June 1965.

WILLIAM HENRY SONNER
Assistant Professor of Psysical Education, B.S., North Carolina State of the U. of N. C. at Raleigh; M.ED., University of North Carolina at Chapel Hill

VICTOR G. SORRELL
Head Basketball Coach, Athletics

JASON LOY SOX, JR.
Instructor in Mathematics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JAMES MAURICE SPAIN
Associate Professor of Soil Science, B.S., Texas Technological College; M.S., PH.D., Purdue University

MARVIN RANDOLPH SPARKS
Wood Utilization Specialist in Industrial Extension Service, B.S., North Carolina State of the U. of N. C. at Raleigh

MARVIN LUTHER SPECK
William Neal Reynolds Distinguished Professor of Food Science, B.S., M.S., University of Maryland; PH.D., Cornell University

HERBERT E. SPEECE
Head of Department of Mathematics and Science Education and Professor of Education and Mathematics, B.A., York College; M.S., North Carolina State of the U. of N. C. at Raleigh; M.A., Texas Christian University; PH.D., University of North Carolina at Chapel Hill

GEORGE S. SPEIDEL, JR.
Instructor in Mathematics, B.S., United States Military Academy; M.A.T., Duke University

JAMES A. SPENCER
Research Instructor in Plant Pathology, B.S., M.S., University of Arkansas

WILLIAM ELDON SPLINTER
Professor of Agricultural Engineering, B.S., University of Nebraska; M.S., PH.D., Michigan State University; PROF. ENG.

DAVID GRIFFIN SPRUILL
Extension Assistant Professor of Animal Science, B.S., M.S., North Carolina State of of the U. of N. C. at Raleigh

EDWARD M. STACK
Professor of Modern Languages, A.B., M.A., PH.D., Princeton University

RALPH WINSTON STACY
Professor of Experimental Statistics and Zoology, B.S.E., Miami University (Ohio); M.S., PH.D., Ohio State University

HANS HEINRICH STADELMAIER
Research Professor of Metallurgy in Engineering Research, DIPLOMA IN PHYSICS, Technische Hochschule (Germany)

RICHARD JAMES STADTHERR
Extension Assistant Professor of Horticultural Science, B.S., M.S., PH.D., University of Minnesota

DONALD B. STAFFORD
Instructor in Civil Engineering, B.S., North Carolina State of the U. of N. C. at Raleigh

EDWARD PAUL STAHEL
Assistant Professor of Chemical Engineering, B.S.E., Princeton University; M.S., University of Notre Dame; PH.D., Ohio State University

RAYMOND FRANKLIN STAINBACK
Associate Professor of Physics, B.S., M.S., University of North Carolina at Chapel Hill

DAVID WARREN STALLINGS
Instructor in Mechanical Engineering, B.S.M.E.A., M.S.M.E., North Carolina State of U. of N. C. at Raleigh

ERNEST M. STALLINGS
Extension Instructor in Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

ALFRED J. STAMM
Reuben B. Robertson Distinguished Professor of Wood Chemistry, B.S., California Institute of Technology; M.S., PH.D., University of Wisconsin

DAVID BROWNING STANSEL
Assistant Director of the Division of General Extension, B.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM McKIMMON STANTON
Extension Instructor in Forest Management, B.S., M.F., North Carolina State of the U. of N. C. at Raleigh

MARVIN EUGENE STARNES
Assistant Director of the Division of General Extension, B.S., North Carolina State of the U. of N. C. at Raleigh

ROBERT GEORGE DOUGLAS STEEL
Professor of Experimental Statistics, B.A., B.S., Mount Allison University; M.S., Acadia University (Canada); PH.D., Iowa State University

STANLEY GEORGE STEPHENS
William Neal Reynolds Distinguished Professor of Genetics, B.A.DIP.AGRI., M.A., Cambridge University; PH.D., Edinburgh University (Great Britain)

JAMES SETH STEVENS, JR.
Adjunct Associate Professor of Recreation and Park Administration, B.S., University of New Hampshire; M.A., New York University

WILLIAM DAMON STEVENSON, JR.
Professor of Electrical Engineering, B.S.E., Princeton University; B.S.E.E., Carnegie Institute of Technology; M.S., University of Michigan

HAMILTON ARLO STEWART
Assistant Director of Research of Agricultural Experiment Station and Professor of Animal Science, B.S., M.S., Kansas State College; PH.D., University of Minnesota

JAMES JACKSON STEWART
Dean of Student Affairs, A.B., Davidson College; M.A., Columbia University

BILL JUNIOR STINES
Assistant Statistician in Experimental Statistics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

EDWARD HOYLE STINSON
Instructor in Engineering Graphics, B.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM J. STOBER
Assistant Professor of Economics, B.S., Washington and Lee University; M.A., Duke University

MARGARET JONES STONE
Instructor in Mathematics, A.B., M.A., Duke University

PAUL SAMUEL STONE
Extension Instructor in Agricultural Economics, B.S., M.S., North Carolina State of the U. of N.C. at Raleigh

ROBERT FRANKLIN STOOPS
Research Professor of Ceramic Engineering in Engineering Research, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., PH.D., Ohio State University

CHARLES CARMEN STOTT
Assistant Professor of Recreation and Park Administration, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., Indiana University

RODERICK PAUL STRICKLAND
Research Assistant in Crop Science, B.S., North Carolina State of the U. of N. C. at Raleigh

DAVID LEWIS STRIDER
Associate Professor of Plant Pathology, B.S., M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

RAIMOND ALDRICH STRUBLE
Professor of Mathematics, B.S., M.S., PH.D., University of Notre Dame

ARCHIE DAVID STUART
Extension Professor of Crop Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

DUNCAN ROBERT STUART
Professor of Design, University of Oklahoma; Chouinard Art Institute; Yale University

WILLIAM CLIFTON STUCKEY, JR.
Associate Professor of Textile Technology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JACK SUBERMAN
Director of Summer Sessions and Professor of English, A.B., M.A., University of Florida; PH.D., University of North Carolina at Chapel Hill

STANLEY KENDRICK SUDDARTH
Visiting Professor of Wood Science and Technology, B.S.F., M.S. PH.D., Purdue University

CHARLES WILSON SUGGS
Associate Professor of Agricultural Engineering, B.S., M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

J. GWYN SUTHERLAND
Research Professor of Agricultural Economics, B.S., Appalachian State Teachers' College; PH.D., North Carolina State of the U. of N. C. at Raleigh

PAUL PORTER SUTTON
Professor of Chemistry, PH.D., Johns Hopkins University

STANLEY SUVAL
Assistant Professor in History and Political Science, B.A., Cornell University; M.A., PH.D., University of North Carolina at Chapel Hill

LOUIS HALL SWAIN
Associate Professor of English, B.S., M.A., Duke University

HAROLD E. SWAISGOOD
Assistant Professor of Food Science, B.S., Ohio State University; PH.D. Michigan State University

RALPH CLAY SWANN
Head of Department and Professor of Chemistry, B.S., Morris Harvey College; PH.D., Massachusetts Institute of Technology

ERNST WARNER SWANSON
Head of Department and Professor of Economics, PH.B., PH.D., University of Chicago

JOHN FRANCIS SWATEK
Assistant Professor of Air Science, B.S., DePaul University

BANKS COOPER TALLEY, JR.
Director of Student Activities Department, Student Affairs, A.B., M.A., University of North Carolina at Chapel Hill

REYHAN TANSAL
Instructor in Mathematics, A.B., Sweetbriar College

FRED RUSSELL TARVER
Extension Associate Professor of Food Science, B.S., M.S., University of Tennessee; PH.D., University of Georgia

BRITA M. TATE
Assistant Social Director, College Union

EARL WILSON TAYLOR
Assistant Professor of Architecture, B.ARCH., North Carolina State of the U. of N. C. at Raleigh

HERMAN WARD TAYLOR
Director of Alumni Affairs, M.S., North Carolina State of the U. of N. C. at Raleigh

THOMAS CULLOM TAYLOR
Special Lecturer in Economics, B.S., University of North Carolina at Chapel Hill

WILLIAM RONALD TAYLOR
Assistant Professor of Design, B.F.A., Atlanta Art Institute; M.F.A., University of Georgia

DAVID BOYCE TEAGUE
Instructor in Mathematics, B.S.E.E., M.S., North Carolina State of the U. of N. C. at Raleigh

THOMAS R. TERRILL
Extension Instructor in Crop Science, B.S., M.S., Pennsylvania State University

DAVID LEE TERRY
Research Instructor in Soil Science, B.S., M.S., University of Kentucky

RAYMOND E. TEW
Placement Director, School of Engineering, B.S., Florida State University

FRANK BANCROFT THOMAS
Extension Associate Professor of Food Science, B.S., University of Delaware; M.S., PH.D., Pennsylvania State University

RICHARD JOSEPH THOMAS
Assistant Professor of Wood Technology, B.S., Pennsylvania State University; M.W.T., North Carolina State of the U. of N.C. at Raleigh

DONALD L. THOMPSON
Research Professor of Crop Science, B.S., M.S., South Dakota State College; PH.D., Iowa State College

OLIVER GEORGE THOMPSON
Assistant Professor of Economics, B.A., Wofford College; M.A., Wake Forest College

WILLIAM A. B. THOMSON
Assistant Professor of Food Science, B.SC., University of St. Andrews (Great Britain); M.S., PH.D., University of Wisconsin

EDWIN GILBERT THURLOW
Professor of Landscape Architecture, B.S., North Carolina State of the U. of N. C. at Raleigh; M.L.A., Harvard University

DAVID HARRY TIMOTHY
Associate Professor of Crop Science, B.S., M.S., Pennsylvania State University; PH.D., University of Minnesota

TSUAN WU TING
Associate Professor of Mathematics, B.S.M.S., China National Central University; M.S.M.E., University of Rhode Island; M.A., PH.D., Indiana University

HAROLD LESLIE TITUS
Assistant Professor of Modern Languages, B.A., McGill University (Canada); M.A., Harvard University; LL.B., University of Alabama; LL.M., New York University

FURNEY ALBERT TODD
Extension Professor of Plant Pathology, B.S., North Carolina State of the U. of N. C. at Raleigh

GEORGE STANFORD TOLLEY
Professor of Agricultural Economics, B.A., American University; M.A., PH.D., University of Chicago

WILLIAM BELL TOOLE, III
Assistant Professor of English, A.B., Presbyterian College; M.A., PH.D., Vanderbilt University

WALTER GLENN TOOMEY
Extension Instructor in Crop Science, B.S., Clemson College

HUSEYIN CAVIT TOPAKOGLU
Assistant Professor of Mechanical Engineering, M.S., PH.D., Technical University of Istanbul (Turkey)

JAMES FRANKLIN TORRENCE
Reactor Operations Engineer in Nuclear Reactor Project, B.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM DOUGLAS TOUSSAINT
Professor of Agricultural Economics, B.S., North Dakota Agricultural College; M.S., PH.D., Iowa State College

SAMUEL B. TOVE
Professor of Animal Science, B.S., Cornell University; M.S., PH.D., University of Wisconsin

JEHU BENJAMIN TRAVIS
Industrial Specialist in Industrial Extension Service, B.S., North Carolina State of the U. of N. C. at Raleigh

HORACE MAYNARD TRENT
Adjunct Professor of Applied Mathematics and Engineering, A.B., Berea College; M.A., PH.D., Indiana University

ANASTASIOS CHRISTOS TRIANTAPHYLLOU
Associate Professor of Genetics, Athens Superior School of Agriculture; PH.D., North Carolina State of the U. of N. C. at Raleigh

HEDWIG HIRSCHMANN TRIANTAPHYLLOU
Associate Professor of Plant Pathology, PH.D., University of Erlangen (Germany)

ROBERT TINNEN TROXLER
Assistant Professor of Industrial Arts, B.S., M.I.A., North Carolina State of U. of N. C. at Raleigh

* JAMES RICHARD TROYER
Associate Professor of Botany and Bacteriology, B.A., DePauw University; M.S., Ohio State University; PH.D., Columbia University

ROBERT WESLEY TRUITT
Head of Department and Professor of Mechanical Engineering, B.A., Elon College; M.S., PH.D., Virginia Polytechnic Institute; PROF. ENG.

GEORGE EUGENE TUCKER
Assistant Professor of Industrial Engineering, B.S.M.E., Alabama Polytechnic Institute; M.S., North Carolina State of the U. of N. C. at Raleigh

PAUL ARTHUR TUCKER, JR.
Research Instructor in Textile Technology, B.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM PRESTON TUCKER
Associate Professor of Chemistry, B.S., Wake Forest College; M.A., PH.D., University of North Carolina at Chapel Hill

ANNE LEACH TURNER
Chief Bibliographer, D. H. Hill Library, B.A., University of North Carolina at Chapel Hill; B.S.L.S., Columbia University; M.A.L.S., University of Michigan

CARL B. TURNER
Instructor in Economics, A.B., Duke University; M.A., Harvard University

WILLIAM LINDSAY TURNER
Business Manager and Extension Professor of Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; D.P.A., Harvard University

GEORGE FRANKLIN TURNIPSEED
Research Assistant Professor of Entomology, B.S., Alabama Polytechnic Institute

CHARLES HENRY UFEN
Assistant Professor of Economics, A.B., M.A., University of North Carolina at Chapel Hill

LESTER CURTIS ULBERG
Professor of Animal Science, B.S., M.S., PH.D., University of Wisconsin

VON HARVEY UNDERWOOD
Instructor in Horticultural Science, B.S., North Carolina State of the U. of N. C. at Raleigh

JEFFERSON WOODROW UPCHURCH, JR.
Assistant Editor in Agricultural Information, A.B., University of North Carolina at Chapel Hill

MARILYN MORRISSETTE UPCHURCH
Instructor in English, A.B., Meredith College; M.A., Duke University

ROBERT PHILLIP UPCHURCH
Professor of Crop Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of California

MARY F. USRY
Counselor, Student Affairs, A.B., University of North Carolina at Greensboro

MEHMET ENSAR UYANIK
Professor of Civil Engineering, B.S.C.E., M.S., PH.D., University of Illinois; PROF. ENG.

RUBY PEARSON UZZLE
Extension Assistant Professor of Agricultural Economics, B.A., Meredith College

---

* Leave of absence, September, 1964-August, 1965.

HUBERTUS ROBERT VAN derVAART
Professor of Experimental Statistics and Mathematics, PH.D., Leiden University (The Netherlands)

DEAN FREDERICK VAN DYK
Mineral Dressing Engineer in Engineering Research, B.S., Michigan College of Mining and Technology

ARTHUR RALPH VERBECK
Research Instructor in Textile Research, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

KURUVILLA VERGHESE
Visiting Assistant Professor of Nuclear Engineering, B.S., College of Engineering, Trivandrum (Kerala, India); M.S., PH.D., Iowa State University

FRANCIS JOSEPH VERLINDEN
Research Associate Technologist in Experimental Statistics, B.CH.E., Catholic University; M.S., North Carolina State of the U. of N. C. at Raleigh

JAMES EDWARD VIA
Extension Instructor in Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

T. S. VISWANATHAN
Visiting Research Associate in Engineering Research, B.S., M.S., India Institute of Science (Bangalore, India); PH.D., India Institute of Technology (Kharagpeer, India)

RICHARD JAMES VOLK
Associate Professor of Soils, B.S., M.S., Purdue University; PH.D., North Carolina State of the U. of N. C. at Raleigh

GEORGE HENRY WAHL, JR.
Assistant Professor of Chemistry, B.S., Fordham College; M.S., PH.D., New York University

HARVEY EDWARD WAHLS
Associate Professor of Civil Engineering, B.S.C.E., M.S.C.E., PH.D., Northwestern University

JAMES BAIRD WALKER
Assistant Professor of Engineering Mechanics, B.S.M.E., M.S.M.E., North Carolina State of the U. of N. C. at Raleigh; PH.D., Brown University

JAMES LESTER WALKER
Visiting Assistant Professor of Soil Science, B.S., PH.D., University of Hawaii

MONROE ELIOT WALL
Adjunct Professor of Chemistry, B.S., M.S., PH.D., Rutgers University

JAMES CLARENCE WALLACE
Assistant Professor of Social Studies, B.S., A.B., M.A., LL.B., University of North Carolina at Chapel Hill

THOMAS DUDLEY WALLACE
Associate Professor of Agricultural Economics and Experimental Statistics, B.S., M.S., Oklahoma State University; PH.D., University of Chicago

JERRY MARVIN WALLER
Instructor in Metallurgical Engineering, B.S.MET.E., M.S.MET.E., North Carolina State of the U. of N. C. at Raleigh

RICHARD GAITHER WALSER
Professor of English, B.A., M.A., University of North Carolina at Chapel Hill

WILLIAM KERSHAW WALSH
Research Assistant in Textile Research, B.S., M.S., University of South Carolina

ARTHUR WALTER WALTNER
Professor of Physics, B.A., Bethel College; M.S., Kansas State College; PH.D., University of North Carolina at Chapel Hill

FU TSENG WANG
Assistant Statistician in the Institute of Statistics, B.S., National University of Chekiang (China); M.A., State University of Washington

SHOU-LING WANG
Visiting Associate Professor of Engineering Mechanics, B.S., St. John's University (Shanghai, China); M.S., Yale University; PH.D., University of Illinois

YI WANG
Instructor in Agricultural Economics, A.B., Taiwan Provincial College (Formosa); M.S., PH.D., Ohio State University

THOMAS MARSH WARD
Instructor in Chemistry, A.B., University of North Carolina at Chapel Hill; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

FREDERICK GAIL WARREN
Professor of Food Science and Processing, B.S., Kansas State College; M.S., PH.D., Pennsylvania State College

WOODLEY CHARLES WARRICK
Extension Associate Professor of Agricultural Engineering, B.S., North Carolina State of the U. of N. C. at Raleigh

RUPERT WILLIAM WATKINS
Extension Assistant Professor of Agricultural Engineering, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

GEORGE CARSON WATSON
Associate Professor of Mathematics, A.B., Randolph-Macon College; M.A., University of Virginia

JULIAN PERRY WATSON
Director of Music Activities, Student Affairs, B.S., Florida State University; M.A., Appalachian State Teachers' College

NORBERT BENJAMIN WATTS
Director of Student Housing, Student Affairs, B.S., North Carolina State of the U. of N. C. at Raleigh

DONOVAN LLOYD WAUGH
Visiting Assistant Professor of Soil Science, B.S., M.S., PH.D., University of Wisconsin

EDWARD WALTER WAUGH
Associate Professor of Architecture, DIPL. IN ARCH., Edinburgh College of Art (Scotland)

CLYDE RAYMOND WEATHERS
Extension Associate Professor of Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JOHN WILLIS WEAVER, JR.
Professor of Agricultural Engineering, B.S., Virginia Polytechnic Institute

BENJAMIN DAVIS WEBB
Instructor in Engineering Graphics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JEROME BERNARD WEBER
Assistant Professor of Crop Science, B.S., M.S., PH.D., University of Minnesota

STERLING BARG WEED
Associate Professor of Soil Science, B.A., Brigham Young University; M.S., PH.D., North Carolina State of the U. of N. C. at Raleigh

JOHN FRANKLIN WEEDON
Sports Information Director, Athletics, B.S., University of Maryland

FREDERICK LOVEJOY WELLMAN
Visiting Professor of Plant Pathology, A.B., University of Wichita; M.A., PH.D., University of Wisconsin

J. C. WELLS
Extension Professor of Plant Pathology, B.S., M.S., University of Georgia

MARTIN ALLAN WELT
Assistant Professor of Nuclear Engineering and Director, Nuclear Reactor Project, B.CH.E., Clarkson College; M.S., Iowa State University; S.M., Massachusetts Institute of Technology; PROF. ENG.

EARL ALLEN WERNSMAN
Assistant Professor of Crop Science, B.S., M.S., University of Illinois; PH.D., Purdue University

OSCAR WESLER
Professor of Experimental Statistics and Mathematics, B.S., City College of New York; M.S., New York University; PH.D., Stanford University

DONALD ALBERT WEST
Assistant Profesor of Agricultural Economics, B.S., University of Toronto (Canada); M.S., University of Minnesota

WILBUR FRANKLIN WESTON
Counselor in the Counseling Department, Student Affairs, B.S., Castleton Teachers' College; M.ED., Boston University

JOSEPH ARTHUR WEYBREW
William Neal Reynolds Distinguished Professor of Plant Chemistry, B.S., M.S., Kansas State College; PH.D., University of Wisconsin

BENNETTE ELAM WHISENANT
Assistant Professor of Air Science, B.S., University of North Carolina at Chapel Hill

ROBERT WHITBREAD
Visiting Assistant Professor of Plant Pathology, B.A., PH.D., Cambridge University (England)

RAYMOND CYRUS WHITE
Professor of Chemistry, B.S., Davis and Elkins College; M.S., PH.D., West Virginia University

ROBERT BENJAMIN WHITE, JR.
Assistant Professor of English, B.A., M.A., University of North Carolina at Chapel Hill

THOMAS KELLEY WHITE, JR.
Instructor in Agricultural Economics, B.S., M.S., University of Georgia

DAVID CALVIN WHITENBERG
Research Assistant Professor of Crop Science, B.S., M.S., PH.D., A & M College of Texas

DONALD WHITESIDE
Instructor in Sociology and Anthropology, B.S., Wisconsin State College; M.S., University of Wisconsin; PH.D., Stanford University

FRED ELWOOD WHITFIELD
Extension Associate Professor of Forest Management, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., Syracuse University

JOHN KERR WHITFIELD
Associate Professor of Mechanical Engineering, B.M.E., M.S., North Carolina State of the U. of N. C. at Raleigh

LARRY ALSTON WHITFORD
Professor of Botany and Bacteriology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Ohio State University

ROBERT EARL WIGGINS
Associate Professor of Textile Technology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

WILLIAM AUGUSTUS WILDER, JR.
Instructor in Animal Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JOHN FRANCIS WILES
Extension Instructor in Food Science, B.I.E., North Carolina State of the U. of N. C. at Raleigh

RUDOLPH WILLARD
Visiting Lecturer in Furniture Manufacturing and Management, Industrial Engineering, PH.B., Yale University; PROF. ENG.

CLIFF RUFUS WILLEY
Assistant Professor of Agricultural Engineering, B.S., M.S., Cornell University; PH.D., University of Wisconsin

HARVEY PAGE WILLIAMS
Professor of Mathematics, B.A., College of William and Mary; M.A., Duke University

JAMES CLIFFORD WILLIAMS, III
Associate Professor of Mechanical Engineering, B.S., M.S., Virginia Polytechnic Institute; PH.D., University of Southern California

MARY CAMERON WILLIAMS
Special Lecturer in English, B.A., Wellesley College; M.A., University of North Carolina at Chapel Hill

PORTER WILLIAMS, JR.
Associate Professor of English, A.B., University of the South; M.A., University of Virginia; B.A., M.A., Cambridge University (England)

JAMES CLAUDE WILLIAMSON, JR.
Assistant Director of Research and Agricultural Extension and Professor of Agricultural Economics, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

RALPH EDWARD WILLIAMSON
Assistant Professor of Agricultural Engineering and Botany, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., PH.D., University of Wisconsin

JAMES BLAKE WILSON
Associate Professor of Mathematics, M.S., Cornell University; B.S., PH.D., University of Florida

LUCY COLE WILSON
Librarian in the Tobacco Literature Service, B.S.L.S., Columbia University

WOODROW OZDELL WILSON
Assistant Professor of Military Science, B.B.A., Northeastern University

GEORGE LUTHER WINCHESTER
Research Assistant in Engineering Research, B.S., North Carolina State of the U. of N. C. at Raleigh

EDWIN WEEMS WINKLER
Associate Professor of Electrical Engineering, B.S., Montana State College; M.S., University of North Carolina at Chapel Hill

NASH NICKS WINSTEAD
Professor of Plant Pathology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., University of Wisconsin

SANFORD RICHARD WINSTON
Professor of Sociology and Anthropology, B.A., Western Reserve University; PH.D., University of Minnesota

LOWELL SHERIDAN WINTON
Professor of Mathematics, B.S., Grove City College; M.A., Oberlin College; PH.D., Duke University

GEORGE HERMAN WISE
Head of Animal Nutrition Section and William Neal Reynolds Distinguished Professor of Animal Science, B.S., Clemson College; M.S., PH.D., University of Minnesota

MILTON BEE WISE
Professor of Animal Science, B.S., Berea College; M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Cornell University

EDWARD HEMPSTEAD WISER
Instructor in Agricultural Engineering, B.S., Iowa State College; M.S., North Carolina State of the U. of N. C. at Raleigh

LAWRENCE M. WODEHOUSE
Assistant Professor of Architecture, DIPL. ARCH., University of Durham (England); DIPL., TOWN PLANNING, University of London; M.ARCH., Cornell University

WILLIE GARLAND WOLTZ
Professor of Soil Science, B.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Cornell University

ROBERT NEWLIN WOOD
Assistant Director of Foundations, B.S., North Carolina State of the U. of N. C. at Raleigh

THOMAS WILMONT WOOD
Professor of Economics, B.S., M.A., University of Alabama; PH.D., University of North Carolina at Chapel Hill

CHARLES EDWARD WOODALL
Campus Consultant, B.ARCH., North Carolina State of the U. of N. C. at Raleigh

JOSEPH RAYMOND WOODARD
Extension Associate Professor of Animal Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JAMES WOODBURN
Professor of Mechanical Engineering, B.S.M.E., Purdue University; DR.ENGR., Johns Hopkins University

MARGARET CHRISTIAN WOODHOUSE
Associate Director, International Student Center. Student Affairs, College of William and Mary

WILLIAM WALTON WOODHOUSE, JR.
Professor of Soil Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Cornell University

JAMES R. WOODRUFF
Extension Instructor in Soil Science, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

OSCAR B. WOOLDRIDGE
Coordinator of Religious Affairs, Student Affairs, B.A., Randolph-Macon College; B.D., Yale Divinity School

ROBERT WYLLIE WORK
Director of Textile Research and Professor of Textiles, B.S., University of Illinois; PH.D., Cornell University

ARCH DOUGLAS WORSHAM
Extension Associate Professor of Crop Science, B.S., M.S., University of Georgia; PH.D., North Carolina State of the U. of N. C. at Raleigh

CHARLES GERALD WRIGHT
Assistant Professor of Entomology, B.S., M.S., University of Maryland; PH.D., North Carolina State of the U. of N. C. at Raleigh

FARRIN SCOTT WRIGHT
Research Instructor in Agricultural Engineering, B.S., M.S., Clemson College

ROBERT BAKER WYNNE
Associate Professor of English, B.A., M.A., College of William and Mary

*JAMES TSING-SEN YEN
Associate Professor of Mechanical Engineering, B.S., Taiwan College of Engineering (Formosa); M.S., PH.D., University of Minnesota

DAVID A. YOUNG, JR.
Professor of Entomology, B.A., University of Louisville; M.S., Cornell University; PH.D., University of Kansas

JAMES NEAL YOUNG
Assistant Director of Instruction and Associate Professor of Rural Sociology, B.S., Clemson College; M.S., PH.D., University of Kentucky

TALMAGE BRIAN YOUNG
Associate Professor of Industrial Arts, B.S., Berry College; M.A.ED., ED.D., University of Florida

CARMEN MARIN ZAIC
Head Tobacco Literature Services, B.A., Rodriguez Marin (Seville, Spain); DIPL., LIB.SCI., International Institute (Spain)

DONALD CARL ZEIGER
Assistant Professor of Horticultural Science, B.S., Ohio State University; M.S., Kansas State College; PH.D., Rutgers University

† PAUL ZUNG-TEH ZIA
Associate Professor of Civil Engineering, B.S.C.E., National Chiao Tung University (China); M.S.C.E., University of Washington; PH.D., University of Florida; PROF. ENG.

ZENON ALBERT ZIELINSKI
Associate Professor of Architecture, M.S., PH.D., Warsaw University of Technology (Poland)

BRUCE J. ZOBEL
Edwin F. Conger Distinguished Professor of Forest Genetics, B.S., M.F., PH.D., University of California

CARL FRANK ZOROWSKI
Professor of Mechanical Engineering, B.S., M.S., PH.D., Carnegie Institute of Technology

---

*Leave of absence, February, 1964-January, 1965.
†Leave of absence, July, 1964-June, 1965.

EMERITUS FACULTY

BARTHOLOMEW BRANDNER BRANDT
Professor Emeritus of Zoology, B.S., Mississippi State College; A.M., PH.D., Duke University

WILLIAM STALEY BRIDGES
Associate Professor Emeritus of Mechanical Engineering; B.E., M.S., North Carolina State of the U. of N. C. at Raleigh

HERMON BURKE BRIGGS
Professor Emeritus of Engineering Drawing and Descriptive Geometry, B.E., M.E., North Carolina State of the U. of N. C. at Raleigh

PERLEY FLOYD BROOKENS
Associate Professor Emeritus of Economics, B.A., University of South Dakota; PH.D., University of Maryland

BENJAMIN FRANKLIN BROWN
Dean Emeritus of the Basic Division, B.S., Northwestern University

THOMAS EVERETTE BROWNE
Director Emeritus of the Division of Teacher Education, B.A., Wake Forest College; M.A., Columbia University

JOSEPH DEADRICK CLARK
Professor Emeritus of English, B.S., Columbia University; M.A., Harvard University

EDWARD LAMAR CLOYD
Dean Emeritus of Students, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

JAMES KIRK COGGIN
Professor Emeritus of Agricultural Education, B.S., North Carolina State of the U. of N. C. at Raleigh; M.S., Cornell University

GERTRUDE MARY COX
Professor Emeritus of Experimental Statistics, B.S., M.S., Iowa State College; SC.D. (Hon.) Iowa State College

HILBERT ADAM FISHER
Professor Emeritus of Mathematics, M.S., North Carolina State of the U. of N. C. at Raleigh; Graduate, United States Naval Academy; Graduate, United States Submarine School; LL.D., Lenoir-Rhyne College

RAYMOND SPIVEY FOURAKER
Professor Emeritus of Electrical Engineering, B.S., A. & M. College of Texas; M.S., University of Texas

KARL BROWNING GLENN
Associate Professor Emeritus of Electrical Engineering, B.E., M.S., North Carolina State of the U. of N. C. at Raleigh

CLAUDE DELBERT GRINNELLS
Professor Emeritus of Animal Husbandry, B.S., M.S., University of Minnesota, D.V.S., Cornell University

FREDERICK MORGAN HAIG
Professor Emeritus of Animal Science, B.S., University of Maryland; M.S., North Carolina State of the U. of N. C. at Raleigh

MINNIE WILFORD CALDWELL HARRIS
Instructor Emeritus in Physics, A.B., B.S., M.S., University of Missouri

JOHN THOMAS HILTON
Professor Emeritus of Textiles, Diploma, Bradford Durfee Textile School; B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

EARL HENRY HOSTETLER
Professor Emeritus of Animal Husbandry, B.S.A., Kansas State Agricultural College; M.AGRI., M.S., North Carolina State of the U. of N. C. at Raleigh

WALTER EDWARD JORDAN
Associate Professor Emeritus of Chemistry, B.S., M.S., Wake Forest College; M.E., North Carolina State of the U. of N. C. at Raleigh

CLAUDE MILTON LAMBE
Assistant Professor Emeritus of Civil Engineering; B.E., North Carolina State of the U. of N. C. at Raleigh

JOHN HAROLD LAMPE
Dean Emeritus of the School of Engineering and Professor of Electrical Engineering, B.S., M.S., D.ENGR., Johns Hopkins University

WILLIAM D. LEE
Associate Professor Emeritus of Agronomy, B.S., North Carolina State of the U. of N. C. at Raleigh

SAMUEL GEORGE LEHMAN
Professor Emeritus of Plant Pathology, B.S., Ohio University; M.S., North Carolina State of the U. of N. C. at Raleigh; PH.D., Washington University

JOHN GRAY LEWIS
Associate Professor Emeritus in Knitting Technology, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

MALCOLM LEWIS
Instructor Emeritus in Mechanical Engineering, B.S., Massachusetts Institute of Technology

ROGER POWELL MARSHALL
Professor Emeritus of English, B.A., Wake Forest College, M.S., North Carolina State of the U. of N. C. at Raleigh, M.A., Columbia University

THOMAS JACKSON MARTIN, JR.
Assistant Professor Emeritus of Mechanical Engineering, B.E., M.S., North Carolina State of the U. of N. C. at Raleigh

GORDON KENNEDY MIDDLETON
Professor Emeritus of Field Crops, B.S., North Carolina State of the U. of N. C. at Raleigh, M.S., PH.D., Cornell University

EDWIN LAWRENCE MILLER, JR.
Associate Professor Emeritus of Geological Engineering, B.S., E.M., Missouri School of Mines and Metallurgy, M.S., North Carolina State of the U. of N. C. at Raleigh

JOHN FLETCHER MILLER
Professor Emeritus of Physical Education, B.PD., Central Missouri Teachers' College, B.P.E., Springfield College

WILLIAM DYKSTRA MILLER
Professor Emeritus of Forest Management, B.A., Reed College, M.F., PH.D., Yale University

THEODORE BERTIS MITCHELL
Professor Emeritus of Entomology, B.S., Massachusetts State College, M.S., North Carolina State of the U. of N. C. at Raleigh, D.S., Harvard University

REUBEN O. MOEN
Professor Emeritus of Economics, B.A., M.A., PH.D., State University of Iowa

THOMAS LEWIS NASH
Instructor Emeritus in Mechanical Engineering, B.S., United States Naval Academy

CLIFTON FLOYD PARRISH
Extension Professor Emeritus of Poultry Science, B.S., North Carolina State of the U. of N. C. at Raleigh

JEHU DEWITT PAULSON
Professor Emeritus of Drawing, B.F.A., Yale University

ROBERT JAMES PEARSALL
Assistant Professor Emeritus of Electrical Engineering, B.E., North Carolina State of the U. of N. C. at Raleigh

GLENN ORVICE RANDALL
Professor Emeritus of Horticultural Science, B.S., University of Arkansas, M.S., Iowa State College of Agriculture

WILLIAM HOUSTON RANKIN
Associate Professor Emeritus of Soils, B.S., M.S., North Carolina State of the U. of N. C. at Raleigh

GEORGE HOWARD SATTERFIELD
Professor Emeritus of Chemistry, A.B., M.A., Duke University, B.S., North Carolina State of the U. of N. C. at Raleigh

IRA OBED SCHAUB
Director Emeritus of the Agricultural Extension Service, B.S., North Carolina State of the U. of N. C. at Raleigh, D.SC., (HON.), Clemson College

ROBERT SCHMIDT
Associate Professor Emeritus of Horticulture, B.S., Rutgers University

CLARENCE BONNER SHULENBERGER
Professor Emeritus of Economics, B.A., Roanoke College; M.A., Columbia University

RUFUS HUMMER SNYDER
Professor Emeritus of Physics, B.S., Lebanon Valley College, A.M., Columbia University, PH.D., Ohio State University

JASPER LEONIDAS STUCKEY
Professor Emeritus of Geology, B.A., M.A., University of North Carolina at Chapel Hill, PH.D., Cornell University

JAMES GRAVES VANN
Business Manager Emeritus, Wake Forest College, North Carolina State of the University of North Carolina at Raleigh

DAVID STATHEM WEAVER
Professor Emeritus of Agricultural Economics, B.S., Ohio State University, M.S., North Carolina State of the U. of N. C. at Raleigh

NATHANIEL WARREN WELDON
Assistant Professor Emeritus of Agricultural Engineering, B.S., North Carolina State of the U. of N. C. at Raleigh

BERTRAM WHITTIER WELLS
Professor Emeritus of Botany, A.B., M.A., Ohio State University; PH.D., University of Chicago

CARLOS FROST WILLIAMS
Professor Emeritus of Horticulture, B.S., Pennsylvania State College, M.S., North Carolina State of the U. of N. C. at Raleigh

HARVEY PAGE WILLIAMS
Professor Emeritus of Mathematics, B.A., College of William and Mary; M.A., Duke University

THOMAS LESLIE WILSON
Professor Emeritus of English, B.A., Catawba College, M.A., Wofford College

LENTHALL WYMAN
Professor Emeritus of Forest Utilization, B.A., M.F., Harvard University

COLLEGE FOUNDATIONS

R. W. SHOFFNER, *Director of Foundations and Development*

Nine foundations, organized and incorporated under the laws of North Carolina, promote and support various North Carolina State programs.

The foundations include the North Carolina State College Foundation, Inc., the North Carolina Agricultural Foundation, Inc., the North Carolina Dairy Foundation, Inc., the North Carolina Engineering Foundation, Inc., the North Carolina Textile Foundation, Inc., the North Carolina Design Foundation, Inc., the North Carolina Forestry Foundation, the Pulp and Paper Foundation, Inc., and the 4-H Development Fund, Inc.

STATE COLLEGE FOUNDATION

The North Carolina State College Foundation, Inc., was organized December 11, 1942, to foster and promote the general welfare of North Carolina State and to receive and administer gifts and donations for such purposes. The Board of Directors is composed of State alumni and members of the Board of Trustees of the University of North Carolina.

AGRICULTURAL FOUNDATION

The North Carolina Agricultural Foundation, Inc., renders financial assistance, through salary supplements, in the development of strong teaching programs in agriculture, and assists the Extension Service and Agricultural Experiment Station of the School of Agriculture and Life Sciences at North Carolina State.

DAIRY FOUNDATION

The North Carolina Dairy Foundation, Inc., aims to promote and improve all phases of dairying in North Carolina through education, research, and extention. A 60 member Board of Directors handles the affairs of the Foundation; these directors represent distributors, producers, and jobbers.

ENGINEERING FOUNDATION

The North Carolina Engineering Foundation, Inc., gives financial assistance to teaching, research, and extension personnel and programs in the School of Engineering.

TEXTILE FOUNDATION

The North Carolina Textile Foundation, Inc., was formed to promote the development of the School of Textiles, and was incorporated December 31, 1942. Funds for this foundation have been raised

largely from textile manufacturing plants and other corporations and industries closely allied with textiles.

DESIGN FOUNDATION

The North Carolina Design Foundation, Inc., was organized January, 1949. Foundation funds are used for the promotion and advancement of architectural education at North Carolina State.

FORESTRY FOUNDATION

The North Carolina Forestry Foundation was incorporated April 15, 1929. The Foundation has acquired a tract of land known as the Hofmann Forest, consisting of about 80,000 acres in Jones and Onslow counties, which is used as a demonstration and research laboratory for forestry students.

PULP AND PAPER FOUNDATION

Thhe Pulp and Paper Foundation, Inc., was incorporated December 19, 1954, by the southern pulp and paper mills for the purpose of supporting the program of pulp and paper technology in the School of Forestry.

4-H DEVELOPMENT FUND

The 4-H Development Fund, Inc., was organized in 1959. 4-H Development Fund monies are used to promote and advance all areas of 4-H Club work in North Carolina.

THE ALUMNI ASSOCIATION

H. W. Taylor, *Director of Alumni Affairs*

Sherrll K. Brinkley, *Assistant Director of Alumni Affairs*

The purpose of the Alumni Association is to promote the growth, progress, and general welfare of North Carolina State; to foster among its former students a sentiment of regard for one another and a continuing attachment to their Alma Mater; and to interest prospective students in attending North Carolina State.

MEMBERSHIP ACTIVITIES

Active membership is available to all former students, regardless of length of stay at the University; members of the faculty, administrative staff, Agricultural Extension Service, Agricultural Experiment Station, teachers of agriculture in North Carolina high schools; and all persons who have successfully completed a short course at

North Carolina State and received a certificate therefor. Honorary membership in the association may be conferred on those distinguished persons as are duly elected.

The association meets annually during Alumni Week. Class reunions, scheduled for each class at five year intervals following graduation, are also held each year in connection with Alumni Week. Officers of the association are elected annually by the active membership by mail ballot. Local alumni clubs are organized in most of the counties in North Carolina and in a number of cities in other states.

ALUMNI FUND

The Alumni Fund was established by the Alumni Association at North Carolina State in 1952 to replace the old dues paying program and to provide a means through which alumni may contribute to the advancement of State. Every alumnus is invited to make an annual contribution.

NORTH CAROLINA STATE ALUMNI NEWS

North Carolina State Alumni News is published monthly by the Alumni Association and sent to Alumni Fund contributors. The magazine enables association members to keep in touch with State and with each other. It carries news and pictures of the University, students and alumni.

THE ALUMNI OFFICE

Records of both graduates and nongraduates are kept by the Alumni Office. The master file includes information on all former students; other files are arranged geographically and by classes. Biographical files are also maintained.

The Alumni Office, which serves as a contact between North Carolina State and her alumni, is located in the Alumni Memorial Building (formerly the Old Infirmary Building), official headquarters for alumni when visiting the campus.

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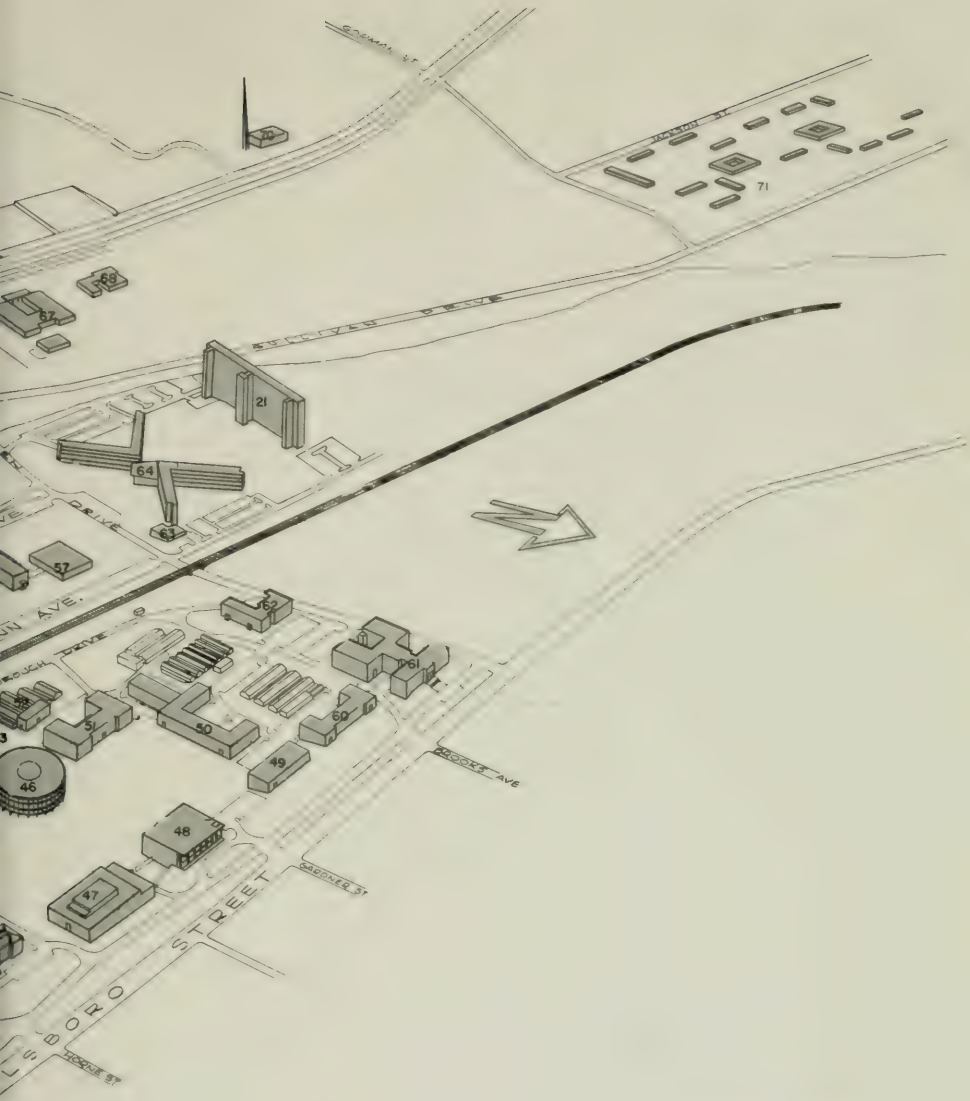
NORTH CAROLINA STATE CAMPUS



1. HOLLADAY
2. ALUMNI
3. PRIMROSE
4. PULLEN
5. PEELE
6. WATAUGA
7. BROOKS
8. FOURTH
9. GOLD
10. WELCH
11. BAGWELL
12. BERRY
13. BECTON
14. CLARK
15. FRANK THOMPSON GYM
16. SYME
17. FIELD HOUSE
19. KING
20. LEAZAR
21. LEE
22. TOMPKINS
23. WINSTON
24. CERAMICS
25. PAGE
26. PARK SHOPS
27. MORRIS
28. LAUNDRY
29. POWER PLANT
30. RIDDICK
31. DANIELS
32. MANN
33. WITHERS
34. 1911 BUILDING
35. RICKS
36. PATTERSON
37. BURLINGTON NUCLEAR LABS
38. WILLIAM NEAL REYNOLDS COLISEUM
39. CARMICHAEL GYMNASIUM
41. ALEXANDER
42. STUDENT SUPPLY STORE
43. BUREAU of MINES
44. BROUGHTON
45. POLK
46. HARRELSON
47. D. H. HILL LIBRARY
48. ERDAHL-CLOYD UNION
49. SCOTT
50. GARDNER
51. WILLIAMS
52. AGRONOMY GREENHOUSES
53. LABORATORY BUILDING
54. OWEN
55. TURLINGTON
56. TUCKER
57. CAFETERIA
60. KILGORE
61. NELSON
62. MANGUM
63. PRINT SHOP
64. BRAGAW
65. BRANDON P. HODGES
66. ROBERTSON
67. AGRICULTURAL ENGINEERING
68. ANIMAL DIAG LABORATORY
70. WUNC-TV
71. MARRIED STUDENT HOUSING
72. FRATERNITY HOUSING

North Carolina State
DIRECTORY
1965

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FACULTY AND STAFF DIRECTORY

1965

North Carolina State
of the University of North Carolina
at Raleigh

COLLEGE EXCHANGE 755-2011

EMERGENCY NUMBERS

In event of fire, call Raleigh Fire Department ..... TE 2-7733
then call Physical Plant 2181

In event of emergency at night, Sundays or Holidays
call Physical Plant Security Desk 2181

In case of accident, call Infirmary 2410
or Rex Hospital ..... VA 8-6211

In event of accident involving radioactive materials,
call ..... 2894 or 2895
or at night ..... 787-2947 or 832-7372

CENTREX TELEPHONE DIRECTORY

Instructions for using the new CENTREX Telephone System follow. Please read them carefully. If you require further instructions regarding use of the new telephone system, dial "0" for Operator and the Campus Attendant will assist you.

CALLING INSTRUCTIONS

Incoming Calls

Anyone who knows your CENTREX number can call your telephone direct without the assistance of an operator. Help your callers by explaining that they can speed their calls to you by dialing direct to 755 plus your four-figure number. If they call from outside the 919 Area, they must dial Area Code 919 before dialing 755.

When the desired number is not known, callers will receive assistance by dialing 755-2011 (Campus CENTREX Attendant).

Local Calls

To other CENTREX telephones—Dial the four-figure number listed in this directory.

To other Raleigh telephones—Dial "9" plus the seven-figure number listed in the Raleigh Telephone Directory.

To report a telephone not operating properly—Dial "9" plus 114. The Telephone Company Repair Service will accept your report.

Long Distance Calls

Long Distance Calls will be billed to your CENTREX telephone number. All "Q" numbers have been discontinued and may not be used after December 13, 1964.

To dial station-to-station Long Distance calls direct, first dial "9" then dial "1" and the Area Code if required, then dial the seven-figure number you are calling.

If your call is collect, person-to-person, or is to be billed to a Credit Card, or another telephone number, dial "9" then dial "0" and the Telephone Company Operator will assist you.

How to Transfer Calls

Remain on the line, depress the receiver plunger once for one second and release. Give the CENTREX Attendant your transfer request. This applies to incoming calls from "outside" telephones only. Other calls cannot be transferred.

Directory and Information Changes

It is important that you advise our Chief Operator (Dial "0") of any and all personnel changes affecting CENTREX Telephone Numbers. This should be done immediately whenever changes occur so Directory and Information Service will always be current.

Telephone Equipment Changes

The following procedures will be used for approval of orders for additions or changes in telephone equipment.

1. To secure technical information and costs, the department heads may contact the Telephone Company Business Office direct prior to submitting a request.
2. The department head will then prepare a letter to the Office of Business Affairs specifying installation charges and annual costs. The letter must designate the availability and source of funds for the service desired.
3. Following approval of the Dean or Director of the School, the letter should be forwarded to the Office of Business Affairs in duplicate.
4. The Office of Business Affairs will determine if funds are available as stated in the request. If so, the Telephone Services Supervisor will process the order with the Telephone Company and the Physical Plant Division.

The Office of Business Affairs insists that budget adjustments necessary to support additional telephone service be submitted and approved in writing prior to initiation of the order to the Telephone Company for the service.

OFFICERS OF ADMINISTRATION

For the Academic Year 1964-1965

THE UNIVERSITY OF NORTH CAROLINA
Chapel Hill, North Carolina

		Chapel Hill
President	William C. Friday	933-1026
Vice President for Academic Affairs	Donald B. Anderson	933-1024
Vice President for Institutional Studies	Arnold K. King	933-2130
Vice President for Administration	Frederick H. Weaver	933-2131
Business Officer and Treasurer	Alexander H. Shepard, Jr.	933-1035

NORTH CAROLINA STATE
Raleigh, North Carolina

Chancellor	John T. Caldwell	A Holladay	2191
Dean of the Faculty	Harry C. Kelly	A Holladay	2192
Business Manager	William L. Turner	109 Holladay	2145
Director of Foundations and Development	Robert W. Shoffner	12 Holladay	2846
Dean of Student Affairs	James J. Stewart	101 Holladay	2446
Dean of the Graduate School	Walter J. Peterson	104 Peele	2871

ADMINISTRATIVE COUNCIL

Chancellor, *Chairman*	John T. Caldwell
Dean of the Faculty	Harry C. Kelly
Dean of the Graduate School	Walter J. Peterson
Dean of Student Affairs	James J. Stewart
Business Manager	William L. Turner
Director of Foundations and Development	Robert W. Shoffner
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Dean, School of Design	Henry L. Kamphoefner
Dean, School of Education	J. Bryant Kirkland
Dean, School of Engineering	Ralph E. Fadum
Dean, School of Forestry	Richard J. Preston
Dean, School of Liberal Arts	Fred V. Cahill
Dean, School of Physical Sciences and Applied Mathematics	Arthur C. Menius
Dean, School of Textiles	Malcolm E. Campbell

ACADEMIC SCHOOLS AND DEPARTMENTS

Department	Head	Office	Ext.
Agriculture and Life Sciences			
Administration			
Dean	H. Brooks James	115 Patterson	2613, 2615
Administrative Officer	Earl B. Peterson	120-G Patterson	2716
Director, *Extension*	George Hyatt, Jr.	104 Ricks	2812
Assoc. Director	George Smith	106 Ricks	2812
Asst. Director, 4-H	T. C. Blalock	202 Ricks	2801
Asst. Director, Training	E. J. Boone	111 Ricks	2819
Asst. Direc., Home Ec.	Eloise Cofer	101-A Ricks	2781, 2782
Asst. Direc., Marketing	J. C. Williamson, Jr.	112 Ricks	2814
State Agent, County	J. E. Foil	110 Ricks	2813
State Home Ec. Leader	Nell Kennett	103 Ricks	2781, 2782
Director, *Instruction*	E. W. Glazener	111 Patterson	2614
Asst. Director	J. N. Young	108 Patterson	2667
Placement Officer	Hugh Bowles	112 Patterson	2668
Director, *Research*	R. L. Lovvorn	107 Patterson	2717
Asst. Direc., Tobacco	K. R. Keller	104 Patterson	2718
Asst. Direc., Bio. Sci.	H. F. Robinson	101 Patterson	2665
Asst. Direc., Animal Res.	H. A. Stewart	109 Patterson	2719
Res. Stations	C. D. Thomas	N. C. Dept. Agri.	829-3236
Asst. Direc., Marketing	J. C. Williamson, Jr.	112 Ricks	2814
Agricultural Institute, Dir.	J. N. Young	108 Patterson	2637
Agricultural Policy Inst. Dir.	C. E. Bishop	216 Patterson	2619
AID, International Programs, Director	J. A. Rigney	1-G Patterson	2671, 2672
Biological Sciences Institute Director	H. F. Robinson	101 Patterson	2665
Departments			
Agricultural Economics	C. E. Bishop	216 Patterson	2619
Exten. Farm Management	Charles Pugh	220 Patterson	2723
Exten. Mktng. Economics	George Capel	210 Patterson	2602
Agricultural Engineering	F. J. Hassler	102 Ag. Engineering	2694
Exten. Ag. Engineering	H. M. Ellis	200 Ag. Engineering	2675
Agricultural Information	W. L. Carpenter	117 Ricks	2807
Animal Science	I. D. Porterfield	123 Polk	2755, 2756
Animal Breeding Section	J. E. Legates	231 Polk	2768
Animal Disease Section	E. G. Batte	Animal Disease Lab	2738
Animal Husbandy and Dairy Husbandry Section	E. R. Barrick	232 Polk	2763
Animal Nutrition Section	G. H. Wise	318 Polk	2773
Exten. Animal Husbandry	Jack Kelly	116 Polk	2761, 2762
Exten. Dairy Husbandry	M. E. Senger	101 Polk	2771
Dairy Records Processing Center	V. H. Lytton	Leazar	2632, 2633
Botany & Bacteriology	G. R. Noggle	146 Gardner	2727
Crop Science	P. H. Harvey	258 Williams	2647
Exten. Agronomy	E. R. Collins	252 Williams	2653
Entomology	E. H. Smith	142 Gardner	2746
Exten. Entomology	G. D. Jones	140 Gardner	2703
Extension Personnel Develop.	E. J. Boone	111 Ricks	2819

Department	Head	Office	Ext.
Extension Home Economics			
Clothing	Mary Em Lee	300 Ricks	2783
Family Relations	Frances Jordan	206 Ricks	2784
Food & Nutrition	S. Virginia Wilson	213 Ricks	2786
Home Management	Katherine Riggle	209 Ricks	2784
Housing-House Furnishings	Charlotte Womble	210 Ricks	2785
Food Science	W. M. Roberts	124 Polk	2796
Exten. Food Science	W. M. Roberts	124 Polk	2796
Genetics	T. J. Mann	353 Gardner	2731
Horticultural Science	F. D. Cochran	118 Kilgore	2684
Exten. Horticulture	J. H. Harris	235 Kilgore	2686, 2687
Plant Pathology	D. E. Ellis	113 Gardner	2737, 2735
Exten. Plant Pathology	H. R. Garriss	9 Gardner	2711
Poultry Science	H. W. Garren	120 Scott	2626
Exten. Poultry Science	W. C. Mills	211 Scott	2621
Rural Sociology	S. C. Mayo	341 1911 Building	2702
Exten. Community Develop.	J. W. Crawford	240 1911 Building	2659
Soil Science	R. J. McCracken	222 Williams	2655, 2656
Exten. Soil Science	E. R. Collins	252 Williams	2653
Zoology	B. S. Martof	155 Gardner	2741
Exten. Wildlife	H. M. Fields	168 Gardner	2741
Design			
Dean	Henry L. Kamphoefner	200 Brooks	2201
Departments			
Architecture	Henry L. Kamphoefner	200 Brooks	2201
Landscape Architecture	Richard A. Moore	200-C Brooks	2202
Product Design	Henry L. Kamphoefner	200 Brooks	2202
Education			
Dean	J. Bryant Kirkland	119 Tompkins	2231, 2232
Departments			
Agricultural Education	C. C. Scarborough	123 Tompkins	2234
Industrial Arts	Ivan Hostetler	106 Tompkins	2237
Industrial Education	D. M. Hanson	111 Tompkins	2241
Mathematics and Science Education	H. E. Speece	103 Tompkins	2239
Occupational Information and Guidance	Roy N. Anderson	209 Tompkins	2244
Psychology	Howard G. Miller	201 Tompkins	2251
Recreation and Park Administration	Thomas I. Hines	Field House	2246, 2247
Engineering			
Dean	Ralph E. Fadum	229 Riddick	2312
Associate Dean	R. G. Carson	232 Riddick	2316
Departments			
Chemical Engineering	E. M. Schoenborn	113 Riddick	2324
Civil Engineering	C. R. Bramer	208 Mann	2331
Electrical Engineering	George B. Hoadley	320-A Daniels	2336
Engineering Mechanics	Patrick H. McDonald	325 Riddick	2341
Engineering Research	N. W. Conner	129 Riddick	2345, 2346

Department	Head	Office	Ext.
Industrial Engineering	Clifton A. Anderson	328 Riddick	2363
Mechanical Engineering	Robert W. Truitt	211 Broughton	2365, 2366
Mineral Industries	W. W. Austin	109 Page	2379
Nuclear Engineering	Raymond L. Murray	5 Burlington Labs.	2302
Engineering Student Affairs, Coordinator of	W. E. Adams	232 Riddick	2315
Freshman Engineering Division Director of	Karl P. Hanson	241 Riddick	2319
Industrial Extension Service	W. C. Bell	3 IES Building	2357
Nuclear Reactor Project	M. A. Welt	31 Burlington Labs.	2321, 2322

Forestry

Dean	R. J. Preston	162 Kilgore	2883, 2884
Departments			
Forest Management	T. E. Maki	152 Kilgore	2885
Wood Science and Technology	Eric L. Ellwood	160 Kilgore	2884
Pulp and Paper Technology	R. G. Hitchings	106 Robertson Lab.	2889
Wood Products Laboratory	Robert C. Gilmore	Hodges Lab.	2881
Forestry Extension	Walter M. Keller	264 Kilgore	2891

Liberal Arts

Dean	Fred V. Cahill	162 Harrelson	2467
Departments			
Economics	Ernst Swanson	121 Harrelson	2471
English	Lodwick Hartley	118 Winston	2461
History and Political Science	Preston W. Edsall	102 Harrelson	2482
Modern Languages	George W. Poland	303 Harrelson	2475
Philosophy and Religion	W. N. Hicks	343 Harrelson	2477
Physical Education	Paul H. Derr	Carmichael Gym	2486
Social Studies	George A. Gullette	144 Harrelson	2479
Sociology and Anthropology	Selz C. Mayo	361 Harrelson	2491

Physical Sciences and Applied Mathematics

Dean	A. C. Menius, Jr.	115 General Lab.	2501, 2502
Asst. Dean	W. O. Doggett	116 General Lab.	2502, 2503
Chemistry Supply Room	B. L. Burnett	26 Withers	2547
Computing Center	D. W. Reid (acting)	Nelson	2518
Departments			
Chemistry	R. C. Swann	107 Withers	2545
Experimental Statistics	D. D. Mason	110 General Lab.	2528
Mathematics	J. W. Cell	252 Harrelson	2382, 2383
Physics	J. T. Lynn (acting)	105 General Lab.	2521, 2522

Textiles

Dean	Malcolm E. Campbell	101 Nelson Textile	2575, 2576
Academic Coordinator	J. W. Klibbe	126 Nelson Textile	2568
Departments			
Knitting Technology	W. E. Shinn	110 Nelson Textile	2573
Machine Design	C. M. Asbill, Jr.	B-22 Nelson Textile	2565

Department	Head	Office	Ext.
Textile Chemistry	Henry A. Rutherford	115 David Clark Lab.	2553
Textile Technology	Elliot B. Grover	103-C Nelson Textile	2577, 2578
Textile Library	Adriana P. Orr	111 Nelson Textile	2562
Textile Research, Director of	R. W. Work	115 David Clark Lab.	2554
Faculty Dean of			
Dean	Harry C. Kelly	A Holladay	2192, 2193
Asst. to the Dean	William H. Simpson	A Holladay	2192, 2193
General Extension Division of			
Director	Edward W. Ruggles	118 1911 Building	2261, 2262, 2267
Graduate School			
Dean	Walter J. Peterson	104 Peele	2871, 2872
Asst. Dean for Research	Frank E. Guthrie	104 Peele	2871, 2745
Library D. H. Hill			
Acting Director	Isaac T. Littleton	126 Library	2843
Associate Director	Harlan C. Brown	301 Library	2843
Acquisitions	Cyrus B. King	113 Library	2841
Catalog	Martha F. Lineberry	109 Library	2841
Chief Bibliographer	Anne L. Turner	108 Library	2842
Circulation	Donald S. Keener	106 Library	2845
Design Library	Harrye Lyons	201 Brooks	2207
Documents	Mary E. Poole	118 Library	2844
Reference	Emma W. Pohl	122 Library	2844
Serials	Gloria W. Houser	12 Library	2842
Textiles Library	Adriana P. Orr	112 Nelson Textile	2562
Tobacco Literature Service	Carmen Zaic	233 Library	2705
Summer School			
Director	Jack Suberman	101 Peele	2864

NON-ACADEMIC DEPARTMENTS AND SERVICES

Alumni Affairs Office of			
Director	H. W. Taylor	103 Alumni	2869, 2860
Asst. Director	Sherrill K. Brinkley	109 Alumni	2869, 2860
Athletics			
Director	Roy B. Clogston	105 Coliseum	2101, 2108
Coaches			
Baseball	Victor G. Sorrell	122 Coliseum	2101, 2104
Asst. Baseball	Nelvin Cooper	Carmichael Gym	2487
Baseball (Freshman)	Jennings B. Edwards	Carmichael Gym	2487
Basketball	Everett N. Case	104 Coliseum	2105
Football	Earle L. Edwards	115 Coliseum	2103

Department	Head	Office	Ext.
Golf	Albert P. Michaels	115 Coliseum	2103
Rifle	Sgt. Edward R. Hutchins	154 Coliseum	2428
Soccer	Max Rhodes	Carmichael Gym	2487
Swimming	Willis R. Casey	122 Coliseum	2101, 2104
Tennis	John F. Kenfield, Jr.	Carmichael Gym	2487
Track	Paul Derr	Carmichael Gym	2486, 2487
Sports Information Director	J. Frank Weedon	124 Coliseum	2101
Wolfpack Club Director	Warren Carroll	108 Coliseum	2112
Business Affairs Office of			
Business Manager	William L. Turner	109 Holladay	2144
Asst. Business Manager	Charles W. Williams	107 Holladay	2147
Auxiliary Services			
Director	Ernest E. Durham	207 Holladay	2157
Central Stores Manager	Joseph L. Barbour	108 Morris	2198
Cafeterias			
Slater Food Services			
Director, Dining Service	A. H. Clarke	Leazar	2879, 2877
Asst. Dir., Dining Service	Lonnie Bell Akridge	Leazar	2878, 2879
Erdahl-Cloyd Union			
Supervisor	Owen F. Morris	Union	2279, 2270
Harris Cafeteria Supervisor	Eugene Stabile	Harris	2857, 2858
Leazar Dining Hall		Leazar	2879
Laundry			
Manager	Joseph R. Gower	Laundry	2122
Print Shop			
Manager	L. B. Phillips	Print Shop	2131, 2132
Asst. Manager	A. Wilton Kelly	Print Shop	2131, 2132, 2133
Budgeting and Accounting, Director	John D. Wright	103 Holladay	2155
Cashier	Jerry LeGarde	B Holladay	2129
Contract and Grant Officer	Glenn E. Musser	10 Holladay	2154
Facilities Planning Division, Director	Carroll L. Mann, Jr.	Watauga	2121
Internal Auditor	James A. Weathers	11 Holladay	2158
Payroll Clerk	Eloise B. Nowell	206 Holladay	2151
Personnel Services, Director	James R. Swiger	Primrose	2135
Physical Plant			
Director	J. McCree Smith	101 Morris	2181
Administrative Asst.	John E. Higgins	111 Morris	2181
Campus Engineer	W. F. Funderburk	203 Morris	2181
Contract Construction Supervisor	Robert E. Fite	201 Morris	2181
Maintenance and Operations			
Asst. Director	Macon R. Rowland	102 Morris	2181
Buildings Supt.	Charles C. Braswell	2 Park Shop	2181
Grounds Supt.	Harold G. Bolick	1 Morris	2181
Power Plant Supt.	Frank R. Kennedy	Power Plant	2181
Shops Supt.	Leon I. Parrish	1 Park Shop	2181
Purchasing Department			
Purchasing Agent	John C. Williams	107 1911 Bldg.	2171
Asst. Purchasing Agent	Felton D. Tilley	106 1911 Bldg.	2171
Student Accounts, Supervisor	William D. Styons	B Holladay	2156
Student Loan Officer	Walter Brown	B Holladay	2144

Department	Head	Office	Ext.
Students Supply Stores			
General Manager	L. L. Ivey	SSS Bldg.	2161, 2163
Asst. Gen. Manager	Mark H. Wheless	SSS Bldg.	2161, 2163
Book Dept. Manager	C. L. Chambers	SSS Bldg.	2161, 2163
Coliseum Concessions Manager	W. L. Gouge, Jr.	119 Coliseum	2123
Fountain Operations Manager	Monty Carde	SSS Bldg.	2161, 2163
SSS Building Manager	G. G. Glass	SSS Bldg.	2161, 2163
Telephone Services and Accounts			
Director	Baye Sumner	Leazar	2141
Supervisor	Bessie B. Turner	116 Winston	0
Traffic Records Office	Esther Hinton	205 Holladay	2120
Coliseum William Neal Reynolds			
Director	Roy B. Clogston	105 Coliseum	2101, 2108
Box Office		Coliseum	2106
Concessions Manager	W. L. Gouge, Jr.	119 Coliseum	2123, 2106, 834-9197
Crop Improvement Association N. C.			
Director	John C. Rice	193 Williams	2851
Asst. Director	Foil W. McLaughlin	193 Williams	2851
Foundation Seed Producers Inc. N. C.			
Manager	R. W. McMillen	124 Williams	2821
Foundations and Development Office of			
Director	Robert W. Shoffner	Holladay	2846, 2847, 2848
Asst. Director	C. W. Hart	Holladay	2846, 2847, 2848
Asst. Director	R. N. Wood	Holladay	2846, 2847, 2848
Information Services Office of			
Director	Hardy D. Berry	202 Holladay	2874, 2875
Assoc. Director	Joseph S. Hancock	202 Holladay	2874, 2875
National Register Records Center			
Manager	George D. Clark	Rm. 100, 505 Oberlin Rd.	2866
Safety and Health for Reactors and Radioisotopes Committee on			
Chairman	William A. Jackson	354 Williams	2637
Vice Chairman	W. O. Doggett	101 Nuclear Science	2527
Radiation Safety			
Radiological Safety Officer	L. T. Caruthers	214 Clark Labs.	2894, 2895
Asst. Radiological Safety Officer	D. W. Morgan	Clark Labs.	2894
Student Affairs Division of			
Dean	James J. Stewart, Jr.	101 Holladay	2446
Student Activities Director	Banks C. Talley, Jr.	202 Peele	2443

Department	Head	Office	Ext.
Admissions and Registration			
Director	Kenneth D. Raab	112 Peele	2431
Asst. Dir. for Admissions	Hugh R. Fordyce	112 Peele	2437
Asst. Dir. for Registration	E. Glenn Overton	2-B Peele	2432
Asst. Dir. for Records	C. P. Greyer	12-E Peele	2434
Student Records and Permanent Files		7-A Peele	2435
Counseling			
Director	Lyle B. Rogers	205 Peele	2422
Asst. Dir. for Financial Aid	Kingston Johns, Jr.	205 Peele	2421
Foreign Students			
Advisor	Roy N. Anderson	209 Tompkins	2244
International Center	Mrs. M. C. Woodhouse	King Building	2415
Music Activities (Bands & Glee Clubs)			
Director	J. Perry Watson	104 Pullen	2401
Placement Center			
Director	Raymond E. Tew	239 Riddick	2318
Publications (Student)	Mrs. Carol H. Kenfield	King Building	2412
Religious Activities			
Coordinator	Oscar B. Wooldridge, Jr.	King Building	2415
Chaplains to Students			
Baptist	LeRoy P. Richardson	Baptist Student Union	
Catholic	Father John Breunig	King Building	2414
Congregational Friends	S. Collins Kilburn	286 Hillsboro St.	832-1119
Disciples of Christ	Keith Roberson	718 Hillsboro St.	832-7112
Eastern Orthodox	E. K. Stephanopoulos	221 S. Person St.	833-1755
Episcopal	Phillip C. Cato	King Building	2414
Jewish	Rabbi Joseph H. Levine	King Building	2414
Lutheran	John Cobb	2723 Clark Ave.	832-9687
Methodist	Neal McGlamery	2501 Clark Ave.	833-1861
Moravian	Alan H. Barnes	3225 Darien Dr.	787-4034
Presbyterian	Donald W. Shriver, Jr.	27 Horne St.	828-5468
ROTC			
Air Force	Col. James D. Howder	145 Coliseum	2417
Army	Col. Lem M. Kelly	154 Coliseum	2428
Military Supply	H. C. Thomas	Frank Thompson Building	2427
Union, Erdahl-Cloyd			
Director	Henry Bowers	Union	2452
Craft Shop Director	Mrs. Carol H. Johnson	Frank Thompson	2457
Directory Service (Student)		Main Desk, Union	2455
Food Service	Owen Morris	Union	2279
Reservations & Information	Mrs. C. S. Philbrick	Main Desk, Union	2455
Theater Director	Ira Allen	Frank Thompson	2457
Television			
Director	George L. Hall	20 TV Studio	2853, 2854
Engineer	H. Ray Bright	24 TV Studio	2853, 2854
Projects	Clive L. Hewitt	22 TV Studio	2853, 2854
Production	George H. Sheehan, Jr.	21 TV Studio	2853, 2854
Visual Aids			
Head	Landis S. Bennett	5 Ricks	2861

COLLEGE COMMITTEES FOR 1964-1965

Admissions

W. D. Toussaint, Chairman
H. R. Fordyce, Secretary
H. A. Petrea
R. M. Pinkerton (Senate)
R. G. D. Steel
R. E. Wiggins

Athletics

R. E. Fadum, Chairman
H. W. Garren
P. H. Derr
J. B. Kirkland
R. J. Monroe

Student Members

John L. Atkins, III
Gary K. Hale
Edward M. Pyatte
Charles E. Wood

Buildings and Grounds

	Term expires Sept. 1
W. W. Woodhouse, Chairman (Senate)	1965
P. A. Bredenberg	1965
H. H. Harris	1965
P. D. Cribbins	1966
R. B. Knight	1966
R. A. Moore	1966
J. W. Horn	1967
C. H. Brett	1967

J. M. Smith, Advisory
C. L. Mann, Jr., *Ex Officio*

Cafeteria Advisory

F. B. Thomas, Chairman
G. L. Capel
E. E. Durham
F. L. Eargle
Mrs. Rachel H. Ferguson
L. S. Winton

Student Members

Eugene O. Eagle
Clyde Alden Kaschub
Bernard Lee Smith
Doug Lientz
Bob Jones

Campus Stores Advisory

C. C. Stott, Chairman
C. R. Bramer
N. G. Eriksen
G. C. Miller
Richard Walser

Student Members

Vernon Glenn Chappell
Alice Edith Herter
James Dee Myers, II

Commencement Advisory

J. S. Doolittle, Chairman
J. R. Lambert
J. A. Porter (Senate)
F. G. Warren

Computing Center Advisory

	Term expires Sept. 1
D. D. Mason, Chairman	1967
J. E. Legates	1967
Ken-ichi Kojima	1966
B. M. Olsen	1966
H. F. Robinson	1965
R. W. Llewellyn	1965

John D. Wright (Business Affairs)
David Reid, *Ex Officio*

Council on Teacher Education

	Term expires February
H. C. Cooke, Chairman	1965
C. C. Scarborough, Secretary	1965
E. O. Beal	1965
R. G. Carson, Jr.	1965
R. L. Dough	1965
M. S. Downs	1965
D. M. Hanson	1965
J. C. Johnson	1965
G. C. Klingman	1965
C. A. Moeller	1965
Guy Owen	1965
N. D. Anderson	1966
G. L. Hall	1966
S. C. Mayo	1966
C. G. Morehead	1966

H. C. Kelly, *Ex Officio*
J. B. Kirkland, *Ex Officio*

COLLEGE COMMITTEES FOR 1964-1965

Courses and Curricula

	Term expires Sept. 1
E. L. Ellwood, Chairman	1965
W. J. Block (Senate)	1965
J. H. Cox	1965
Jack Suberman	1965
E. O. Beal	1966
A. R. Eckels	1966
L. B. Martin	1966
H. E. Speece	1966
D. R. Stuart	1966
J. T. Lynn	1967
D. M. Hoover	1967
H. A. Hassan	1967
R. E. Wiggins	1967

Faculty Hearing

	Term expires Sept. 1
J. S. Doolittle, Chairman	1968
K. L. Barkley	1968
Arthur Kelman	1968
R. J. Monroe	1968
C. H. Bostian	1968
Alternates	
W. W. Austin	
J. E. Legates	
H. M. Nahikian	

Faculty Hospitality and Orientation

W. W. Austin, Chairman
H. D. Cook
Mrs. Ruth B. Hall
F. J. Hassler
W. A. Reid
C. C. Scarborough
W. E. Shinn
F. S. Sloan
E. G. Thurlow

O. Max Gardner Award

C. H. Hamilton, Chairman
J. E. Legates
R. C. Bryant
D. U. Gerstel
E. M. Schoenborn
G. A. Gullette
W. J. Harrington

General Extension

	Term expires Sept. 1
S. C. Mayo, Chairman	1965
C. C. Scarborough	1965
W. C. Bell	1966
D. M. Hanson (Senate)	1966
E. J. Boone	1967
Jack Suberman	1967
W. M. Keller	1967
E. W. Ruggles, *Ex Officio*	

Government

	Term expires Sept. 1
J. F. Lutz	1967
H. D. Bowen	1967
H. G. Miller	1966
A. Holtzman	1966
B. F. Beers	1965
D. D. Mason	1965

Graduate School Administrative Board

	Term expires	
W. J. Peterson, Chairman		
R. L. Anderson	Oct.	1964
D. M. Cates	Aug.	1966
G. O. Doak	Sept.	1967
Arthur Kelman	Nov.	1966
R. L. Lovvorn	March	1965
T. E. Maki	Oct.	1965
P. H .McDonald	Dec.	1964
H. G. Miller	Nov	1967
G. W. Poland	Jan.	1968
W. D. Stevenson	Oct.	1965

Group Insurance and Faculty Welfare

	Term expires Sept. 1
K. S. Campbell, Chairman	1967
C. H. Hamilton	1965
D. M. Peterson	1965
J. S. Doolittle	1966
R. L. Rabb (Senate)	1966
G. A. Gullette	1967
J. O. Rawlings	1968
H. G. Miller	1968
H. A. Rutherford	1969
G. H. Wise	1969
Richard Allen (Business Affairs)	

COLLEGE COMMITTEES FOR 1964-1965

Harrelson Fund

B. F. Beers, Chairman
W. J. Harrington
H. L. Kamphoefner
C. B. King
W. W. Kriegel

History and Naming of Buildings

P. W. Edsall, Chairman
L. W. Barnhardt
C. L. Mann, Jr.
D. J. Rulfs
I. O. Schaub
H. W. Taylor

Library

Term expires Sept. 1

L. C. Hartley, Chairman	1965
L. A. Dow	1965
D. U. Gerstel	1965
C. H. Kahn (Senate)	1965
V. F. Shogren	1966
G. O. Doak	1966
H. A. Shannon	1966
R. W. Work	1966
A. J. Goetze	1967
R. L. Lovvorn	1967
H. G. Kincheloe	1967
R. A. Struble	1967

I. T. Littleton, *Ex Officio*
D. S. Keener, *Ex Officio*

Patents

W. L. Turner, Chairman
C. W. Williams, Vice-Chairman
N. W. Conner
R. L. Lovvorn
R. W. Work
F. C. Eichenberger

Refund of Fees

E. H. Johnson, Chairman
J. W. Kelly
A. M. Hoch
W. R. Styons

Research

W. J. Peterson, Chairman
F. E. Guthrie, Secretary
A. C. Barefoot
N. M. Chansky
R. W. Greenlaw
C. H. Kahn
E. R. Manring
H. A. Stewart
R. W. Truitt
R. W. Work
G. E. Musser, *Ex Officio*

Safety and Health for Reactors and Radioisotopes

Term expires Sept. 1

W. A. Jackson, Chairman	1966
W. O. Doggett, Vice Chairman	1966
D. S. Grosch	1965
Frances Richardson	1965
A. A. Armstrong	1967
R. L. Dough	1967
L. H. Bowen	1968
Hayne Palmour, III	1968

L. T. Caruthers, *Ex Officio*
C. C. Braswell, *Liaison*

Scholarships and Student Aid

H. V. Park, Chairman
Kingston Johns, Jr., Secretary
R. B. Clogston
G. H. Dunlap
R. G. Hitchings
T. I. Hines
J. F. Kenfield (Senate)
W. M. Lewis
E. G. Manning

Social Functions

F. S. Barkalow, Jr., Chairman
G. L. Jones
Mary S. Moser
Charles Smallwood, Jr.
Student Members
Charles Leon Biggs
Harold Earl Blondeau
William R. Cartwright
James Terry Lowder
Michael S. Scofield
Michael W. Smith
Robert W. Smith
John Lennon Sullivan
Allen Kyle Tothill

COLLEGE COMMITTEES FOR 1964-1965

Student Orientation

K. P. Hanson, Chairman
Kingston Johns, Jr., Secretary
D. M. Hoover
J. M. Johnson
W. E. Smith (PE)
W. C. Hackler (Senate)

Student Members

Robert F. Andrews, Jr.
John Davis Barnes
Theta T. Bundy
Frank K. Ferrell
Elliott A. Mayo
Terry Grant Sparks
Bernard Lee Smith
Henry Austin Turlington
Sylvia Janice Williams

Television Advisory

H. C. Cooke, Chairman (Senate)
R. G. Carson
H. D. Berry
Henry Bowers
J. O. Cook
R. L. Dough
F. C. Eichenberger
D. S. Hamby
J. H. Harris
George Hyatt
Jack Porter
H. F. Robinson
E. W. Ruggles
G. L. Hall, *Ex Officio*

Traffic

W. L. Blow, Chairman
W. V. Campbell
Mrs. Nell C. Clifton
P. D. Cribbins (Senate and Liaison)
C. F. Kolb
W. E. Moser
H. L. Owen
D. B. Stafford
R. J. Thomas
R. T. Troxler
N. B. Watts
J. A. Weathers
Mrs. Elizabeth M. Young

Student Members

Hugh A. Johnson
Fred B. Campbell
Woodrow F. Wilson, Jr.
Kent Bernard Foster
John Herbert Hyder

FACULTY SENATE, 1964-1965

Chairman: W. J. Block

Vice-Chairman: H. W. Garren

Secretary: F. M. Richardson

Faculty Senate Membership, 1964-1965

Name	*Term Ending*	*School*	*Address*	*Phone*
Anderson, R. L.	1966	PSAM	111 General Laboratories	2529
Baldwin, T. S.	1966	Education	226 Tompkins	2252
Barclay, W. J.	1966	Engineering	435 Daniels	2337
Beal, E. O.	1966	Agriculture	251 Gardner	2725
Beatty, K. O.	1966	Engineering	114 Riddick	2325
Block, W. J.	1966	Liberal Arts	111 Harrelson	2483
Bostian, C. H.	1965	Agriculture	348 Gardner	2732
Clayton, M. H.	1965	Engineering	317 Riddick	2343
Cooke, H. C.	1966	PSAM	206 Harrelson	2381
Cribbins, P. D.	1966	Engineering	442 Mann	2332
Duffield, J. W.	1966	Forestry	170 Kilgore	2883
Dunlap, G. H.	1966	Textiles	120 Nelson	2572
Garren, H. W.	1966	Agriculture	120 Scott	2626
Hackler, W. C.	1965	Engineering	108-A Page	2377
Hanson, D. M.	1965	Education	111-A Tompkins	2241
Haynes, F. L., Jr.	1965	Agriculture	208 Kilgore	2660
Howder, J. D.	1966	Engineering	145 Coliseum	2417
Kahn, C. H.	1966	Design	314 Brooks	2203
Kenfield, J. F., Jr.	1965	Liberal Arts	Carmichael Gym	2487
King, C. B.	1966	Liberal Arts	112 D. H. Hill Library	2841
Knowles, A. S., Jr.	1965	Liberal Arts	11 Winston	2461
Lammi, J. O.	1965	Forestry	270 Kilgore	2885
Lynn, J. T.	1965	PSAM	105 General Laboratories	2521
Pinkerton, R. M.	1966	Engineering	121 Broughton	2368
Porter, J. A., Jr.	1965	Textiles	226 Nelson	2568
Rabb, R. L.	1965	Agriculture	229 Gardner	2745
Richardson, F. M.	1965	Engineering	206 Riddick	2326
Shogren, V. F.	1965	Design	213 Brooks	2660
Wise, G. H.	1965	Agriculture	304 Polk	2773
Wise, M. B.	1966	Agriculture	220-A Polk	2763
Woodhouse, W. W., Jr.	1965	Agriculture	188-A Williams	2657

FACULTY SENATE STANDING COMMITTEES, 1964-65

Chairman: W. J. Block

Vice-Chairman: H. W. Garren

Secretary: F. M. Richardson

Communications

H. W. Garren, Chairman
P. D. Cribbins
C. H. Kahn

Constitution and By-Laws

H. C. Cooke, Chairman
T. S. Baldwin
M. H. Clayton
V. F. Shogren

Educational Policy

F. L. Haynes, Jr., Chairman
E. O. Beal
J. W. Duffield
J. D. Howder
C. H. Kahn
A. S. Knowles, Jr.
J. T. Lynn
R. M. Pinkerton
J. A. Porter, Jr.

Honorary Degrees

D. M. Hanson, Chairman
W. J. Barclay
M. H. Clayton
A. S. Knowles, Jr.
J. A. Porter, Jr.
W. W. Woodhouse, Jr.

Personnel Policy

R. L. Rabb, Chairman
R. L. Anderson
T. S. Baldwin
W. J. Barclay
J. O. Lammi
G. H. Wise
W. W. Woodhouse, Jr.

Personnel Problems

W. C. Hackler, Chairman
J. D. Howder
V. F. Shogren
G. H. Wise
M. B. Wise

Student Affairs

J. F. Kenfield, Jr., Chairman
K. O. Beatty
C. H. Bostian
G. H. Dunlap
W. C. Hackler
C. B. King
M. B. Wise

Executive Committee

W. J. Block, Chairman
H. W. Garren, Vice-Chairman
F. M. Richardson, Secretary
H. C. Cooke
W. C. Hackler
D. M. Hanson
F. L. Haynes, Jr.
J. F. Kenfield, Jr.
R. L. Rabb

FACULTY AND STAFF DIRECTORY

A

Name, Title, Department, and Address	Office Phone	Res. Phone
*Adams, A. Harvey, Asst. Purchasing Agent, Purchasing 101 1911 Building; 210 E. Second St., Clayton	2171	WA2-6333
Adams, Hazel C., Accounting Clerk, Forestry 162 Kilgore; 405 Brooks Ave.	2883, 2884	TE2-6183
†Adams, Virginia K., Agri. Res. Tech., Food Science Basement Kilgore; 1405 Mordecai Dr.	2691, 2692	TE3-7950
*Adams, William E., Coordinator of Student Affairs, Engineering 232 Riddick; 204 Faircloth St.	2315	832-1393
*Adcock, Donald B., Asst. Director, Music 104 Pullen; 4318 Lambeth Dr.	2401	787-2407
*Addelman, Sidney, Adjunct Asst. Prof., Expt. Statistics Research Triangle Institute, P. O. Box 490, Durham; 4516 Pamlico Dr.	834-6246	787-3076
*Afify, Elsayed M., Visiting Asst. Prof., Mechanical Engr. 102 Broughton; 9 Ashe Ave.	2365	
*Ahlschwede, Margrethe P., Assistant Editor, Agri. Info. 316 Ricks; 3005 Leonard St., Apt. #5	2805, 2809	828-9517
Akkoc, Can, Instructor, Engr. Mechanics 352 Riddick; 2804 Bedford Ave.	2342	832-8778
*Akridge, Lonnie L., Asst. Dir., Dining Services, A.R.A. Slater Leazar Hall; 1914 Fairfield Dr.	2878, 2879	832-8284
*Alberg, Evelyn E., Steno., State Soil & Water Cons. Comm. 387 Williams; 2607 Grant Ave.	2646	828-6919
*Alberg, R. Jarles, In Charge, Extn. Staff Artists, Agri. Info. 13 Ricks; 2607 Grant Ave.	2862	828-6919
*Alberga, Alvyn C., Asst. Prof., Civil Engr. 212 Mann; 3147 Ashel St.	2332	787-3979
*Aldridge, Julius R., Agri. Res. Supt., Animal Breeding, Animal Sci. College Dairy Farm, 4700 Hillsboro St.; 4700 Hillsboro St.	2674	834-0157
*Alexander, Elaine G., Secretary, Computing Center 8-A Nelson Textile; 112 Loop Rd., Garner	2510, 2518	EM2-9932
*Allen, A. V., Extn. Prof., Animal Husbandry Spec., Animal Sci. 111 Polk; 1314 Rand Dr.	2762	832-4564
*Allen, C. Richard, Benefits Officer, Business Affairs 208 Holladay; 225 Forest Rd.	2157	832-7360
*Allen, Doris W., Steno., Agri. Extn. 207 Ricks; Rt. 8, Box 230, Raleigh	2708	787-2608
Allen, Ira W., Theater Director, Erdahl-Cloyd Union Frank Thompson Theater; 2004 Buckingham Rd.	2405	828-8058
*Allgood, James G., Extn. Asst. Prof., Extn. Economist, Agri. Econ. 18-G Patterson; 813 Union St., Cary	2611	467-9547
*Alliston, Charles W., Asst. Prof., Zoology 356 Gardner; 1507 Powell Dr.	2741	832-3972
*Alliston, Katie B., Steno., Crop Science 256 Williams; 1507 Powell Dr.	2648	832-3972
*Allred, Fred J., Assoc. Prof., Modern Languages 308 Harrelson; 3016 Mayview Rd.	2475	TE2-3588
*Alvarez, Raul, Assoc. Prof., Industrial Engr. 338 Riddick; 2610 Churchill Rd.	2362	TE4-6295
*Amein, Michael, Asst. Prof., Civil Engr. 211 Mann; 5301 Inglewood Ln.	2332	787-3870
*Ammerman, Jay P., Farm Supt., Animal Science Rt. 8, Raleigh		833-9267

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Amos, Elizabeth J., Data Processor, Textiles S-61 Nelson Textile; Rt. 6, Leesville Rd.	2571	787-3802
*Anderson, Charles N., Instructor, Mathematics 219 Harrelson; 207 Wilmot Dr.	2385	TE4-7466
*Anderson, Clifton A., Professor & Head, Industrial Engr. 328 Riddick; 320 Yadkin St.	2363	787-1390
*Anderson, Norman D., Asst. Prof., Math. & Science Ed. 104 Tompkins; 400 Winterlochen Rd.	2239	834-8037
*Anderson, Peggy C., Agri. Res. Tech., Animal Science 327 Polk; P-320 McKimmon Village	2773	
*Anderson, Richard L., Grad. Administrator & Prof., Expt. Statistics 111 General Laboratory; 2217 Dixie Tr.	2529	787-4700
*Anderson, Roy N., Professor, Occupational Info. & Guidance 209 Tompkins; 117 Forest Rd.	2244	TE3-4090
*Andrews, Walter G., District Agri. Agent, Agri. Extn. Service 307 Ricks; 2332 Avent Ferry Rd.	2780	832-5109
*Angel, Norman B., Area Coordinator, Industrial Extn. Service B-3 IES Building; 1941 Wendover Dr., Fayetteville	2358	485-3646
*Antinori, Ernest J., Nuclear Electronics Tech., Nuclear Reactor Proj. 32 Burlington Nuclear Lab.; Rt. 1, Box 121-B, Cary	2321	467-1496
*Apple, J. L., Prof. in Plant Pathology, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
Arant, Anamerle, Dist. Home Econ. Agent, Agri. Extn. 203 Ricks; 2402 Clark Ave.	2708	832-2193
†Arey, John A., Extn. Prof. Emeritus, Dairy Husb., Animal Sci. 102 Polk; 5 Maiden Lane	2771	TE2-3535
Arey, Mary L., Secretary, Agri. Econ. 220 Patterson; 5 Maiden Lane	2723	832-3535
*Armstrong, Arthur A., Assoc. Prof., Textiles S-50B Nelson Textile; 3432 Leonard St.	2550	834-1540
*Armstrong, Frank B., Assoc. Prof., Genetics & Bacteriology 29b Gardner; 2757 Toxey's Dr.	2734	828-3013
*Armstrong, L. Otis, Prof. Emeritus, Agri. Education 308 Dixie Tr.		
*Arnold, H. C., Asst. Buildings Supt., Physical Plant 2 Morris; 110 Dennis Ave.	2181	833-4137
*Arrington, Clyde L., Agri. Res. Asst., Agri. Engr. 140 Agri. Engr.; Rt. 1, Box 2, Apex	2663	354-6518
*Asbill, Clarence M., Jr., Head & Prof., Tex. Machine Design B-22 Nelson Textile; 2627 Dover Rd.	2565	832-4957
*Ashe, Dale C., Accounting Clerk, Textiles 108 Nelson Textile; 907 Gardner St.	2557	832-5332
*Atchley, Vickie, Secretary, Agri. Econ. 220 Patterson; 3608 Swift Dr.	2723	834-1206
Atkinson, Lois, Agri. Res. Tech., Food Science 141 Polk; 1310 Hillsboro St.	2795	832-5897
*Aull, Helen L., Statistical Analyst, Poultry Science 202 Scott; 2108 Ridge Rd.	2623	787-4689
*Aurand, Leonard W., Professor, Food Science 128F Polk; 921 Walnut Tr.	2794	TE4-5113
*Austin, William W., Head, Mineral Industries 109 Page; 3221 Birnamwood Rd.	2379	TE2-1738
*Averett, L. T., Mechanic, Research Shop, Agri. Engr. 130 Agri. Engr.; Rt. 7, Raleigh	2681	828-6644
*Averette, Fred G., Res. Superv., Soil Science 422 Williams; Rt. 1, Knightdale	2645	266-2805

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Axtell, Richard C., Asst. Prof., Entomology 235 Gardner; 2703 Avent Ferry Rd.	2745	834-7471
*Aycock, Robert, Professor, Plant Pathology 21 Gardner; 2001 Manuel St.	2712	787-2797
*Ayers, Betty W., Agri. Res. Tech., Soil Science 312 Williams; 1012 Nichols Dr.	2636	828-4800

B

*Badders, F. Hal, Asst. Supt., Utility Dept., Physical Plant Power Plant; 610 Dixie Tr.	2181	832-2452
*Baermann, Walter P., Professor, Product Design 200-D Brooks; 3102 Darien Dr.	2202	832-4675
Bailey, Janie R., Secretary, Mechanical Engr. 211 Broughton; Rt. 7, Raleigh	2365, 2366	787-3526
*Bailey, Sheila C., Addressing Equipment Oper., Agri. Info. 320 Ricks; 1120 Parker St.	2808	
*Baird, Guy B., Asst. Director of Res., Agri. Admin. 102 Patterson, 3734 Swift Dr.	2718	833-8569
*Baird, Jack V., Extn. Assoc. Prof., Soil Fertility, Soil Science 155 Williams; 2304 Hales Rd.	2654	834-6591
*Baker, Bonnie L., Library Asst., Serials 12 Library; Rt. 3, Box 220, Fuquay-Varina	2842	MU7-5057
*Baldwin, Joe G., Adjunct Asst. Prof., Mathematics 226 Harrelson; Apt. 12, Parkwood, Durham		544-2231
*Baldwin, Thomas S., Asst. Prof., Psychology 226 Tompkins; 2611 Fairview Rd.	2252	833-9866
*Ball, Ernest A., Professor, Botany, Botany & Bacteriology 255 Gardner; 1220 Duplin Rd.	2725	833-3047
*Ballenger, Phyllis K., Agri. Res. Tech., Crop Science 102 Williams; 3448 Leonard St.	2640	834-1923
*Ballenger, Stanley T., Assoc. Prof., Modern Languages 306 Harrelson; 2714 Rosedale Ave.	2475	832-9570
*Ballinger, Walter E., Assoc. Prof., Horticultural Science 224 Kilgore; 5612 Winthrop Dr.	2669	787-1805
*Banadyga, A. A., Extn. Prof., Horticultural Science 118 Kilgore	2684	
*Banner, William P., Jr., Clerk, N.R.R.C. 505 Oberlin Road, Room 100; 400 Chamberlain St., Apt. B	2866	834-3336
*Barber, Clifford W., Professor, Poultry Pathology, Poultry Science 225 Scott; 704 Grove St.	2623	833-0278
Barbour, Irma M., Secretary, Soc. & Anthro. 360 Harrelson; 402 Horne St.	2491	TE3-0450
*Barbour, Joseph L., Manager, Central Stores 108 Morris; 218 Hardee St., Clayton	2197, 2198	WA2-7174
*Barbour, Joyce J., Res. Asst., Poultry Science 10 Scott; 226 Wilmot Dr.	2628	834-7175
Barbour, Maxine L., Steno., Rec. & Park Admin. 103 Field House; 2527 County Club Ct.	2246, 2247	834-5610
*Barclay, William J., Professor, Electrical Engr. 435 Daniels; 600 Davidson St.	2337	832-0737
*Barefoot, A. C., Assoc. Prof., Wood Sci. & Tech. 154 Kilgore; 3349 Hampton Rd.	2885	787-4110
Barefoot, Patricia J., Steno., Freshman Engineering Division 241 Riddick; 125½ Woodburn Rd.	2319	828-2917

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Barefoot, Raymond V., Agri. Res. Asst., Animal Breeding, Animal Sci. 2674 College Dairy Farm; Dairy Farm, U.S. 1		
Barefoot, Sue L., Steno., Federal Extn. Service, USDA 2561 212 David Clark Labs.; 1109 Nichols Dr.		828-5339
*Barger, Cleeta P., Agri. Res. Asst., Animal Science 2773 243 Polk; 3904 Arrow Dr.		787-1927
*Barham, Bobbie C., Key Punch Oper., N.R.R.C. 2866 505 Oberlin Road, Room 100; Rt. 7, Raleigh		834-7520
*Barham, Cary G., Dairy Plant Operator, Food Science 2700 Basement Polk; 409 Lansing St.		TE4-8580
*Barkalow, Frederick S., Jr., Professor, Zoology 2741 243 Gardner; 3439 Bradley Pl.		833-4397
*Barkley, Key L., Professor, Psychology 2252 218 Tompkins; 2204 Garden Pl.		834-7098
*Barnes, Alan H., Moravian Chaplain, Student Affairs 787-4034 3225 Darien Dr.; 3225 Darien Dr.		787-4191
*Barnes, Annie G., Res. Tech., Poultry Science 2822 Sensory Physiology Lab., Poultry Research Farm, College Rd.; 2013 Wake Forest Rd.		828-7974
*Barnes, E. Floyd, Agri. Res. Superv., Crop Science 2638 139 Williams; Rt. 1, Raleigh		787-4706
*Barnes, Eleanor B., Clerk, Textiles 2568 126 Nelson Textile; P. O. Box 884, Wendell		365-7301
*Barnes, Lillian M., In Charge, Bureau of Corres. Inst., Gen. Extn. 2264 138 1911 Building; 136 Woodburn Rd.		TE2-5015
*Barnes, Linda W., Steno., Plant Pathology 2721, 2722 5 Gardner; 2115 New Bern Ave.		828-3135
*Barnett, Elaine W., Steno., Industrial Engr. 2363 328 Riddick; 4421 North Blvd.		834-8304
*Barnhardt, Luther W., Assoc. Prof., History & Political Science 2481 105 Harrelson; 2502 Stafford Ave.		832-8796
*Barrett, Rolin F., Instructor, Mechanical Engr. 2366 290 Broughton; 2405 Grant Ave.		828-5117
*Barrick, Elliott R., Professor & Section Head, Animal Science 2763 232 Polk; 5310 Old Stage Rd.		834-2420
*Barrow, Elsie G., Steno., Information Services 2874, 2875 202 Holladay; 716 Grove Ave.		833-0698
*Bartels, Major Henry G., USAF, Asst. Prof., Aerospace Studies 2317, 2318 145 Coliseum; 4923 Grinnell Dr.		787-3476
*Bartholomew, William V., Professor, Soil Science 2637 358 Williams; 618 Stacy St.		TE2-8954
*Bartley, Andrew J., Assoc. Prof., Economics 2472 125 Harrelson; Rt. 4, Raleigh		TE3-3365
*Bassett, Donald G., Instructor, Freshman Engineering Division 2387 275 Broughton; 735 Chappell Dr.		828-7841
*Bassett, Sue L., Steno., Engr. Research 2345, 2346 124 Riddick; 735 Chappell Dr.		VA8-7841
*Batchelor, Robert E., Dup. Unit Supervisor, Agri. Information 2791 23 Ricks; Box 212, Wendell		365-7479
*Batey, Andy H., Agri. Res. Asst., Animal Science 2759 Fincrest Farm; Lake Wheeler Rd.		
*Batte, Edward G., Prof. & Head, Animal Disease Sect., Animal Sci. 2738, 2739 127 Animal Disease Lab.; 715 Beaver Dam Rd.		833-9766
Batten, Perry, Jr., Extn. Retirement & Ins. Officer, Agri. Extn. 2706 105 Ricks; 510 Burton St.		VA8-6360

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Baxter, John D., Res. Engineer, Engr. Research 3 Riddick Annex; 2608 Kilgore Ave.	2347	833-0624
Beaird, Donna R., Secretary, Student Activities 204 Peele; 1021 St. Mary's St.	2442	828-8673
*Beal, Ernest O., Professor, Botany & Bacteriology 250 Gardner; 518 Dixie Tr.	2725	834-5007
*Beam, H. Edwin, Assoc. Prof., Agri. Education 121 Tompkins; 4516 Laurel Hill Rd.	2235	787-3755
*Beamon, Hope S., Library Asst., Circulation Library; 2719-A Kilgore Ave.	2845	828-5048
*Beard, Edwina T., Agri. Res. Tech., Food Science 8 Scott; Apt. Q, 205 McKimmon Village	2628	828-6183
*Beasley, Mary C., Administrative Secretary, Foundations & Devel. 12 Holladay; 714 S. Kimbrough St.	2846	833-9066
*Beatty, Kenneth O., Jr., Professor, Chemical Engr. 114 Riddick; 323 Shepherd St.	2325	833-7626
*Beaver, Phyllis W., Typist, Agri. Engr. 120 Agri. Engr.; 400 Chamberlain St.	2681, 2682	828-9884
Beddingfield, Kitty N., Typist, Purchasing 103 1911 Building; 1611 Oberlin Rd.	2171	834-5467
*Beers, Burton F., Assoc. Prof., History & Political Science 116 Harrelson; 629 South Lakeside Dr.	2481	834-8349
*Beeson, Kenneth C., Visiting Prof. in Animal Sci., Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Behlow, R. F., Extn. Prof., Extn. Veterinarian, Animal Science 109 Polk; 1209 Mindees Ct.	2762	787-1827
*Bell, Norman R., Assoc. Prof., Electrical Engr. 322-B Daniels; 2312 Woodrow Dr.	2338	787-1177
*Bell, Oliver A., Mechanic, Civil Engr. 117 Mann; 2604 Garner Rd.	2332	833-3774
*Bell, Thomas A., Assoc. Prof., USDA, Food Science 310-A Polk; 117 Montgomery St.	2868	TE3-6154
*Bell, William C., Head, Industrial Extension Service 4 IES Building; 3044 Lewis Farm Rd.	2357	833-8242
*Bellflower, Ann S., Steno., Experimental Statistics 513 General Laboratory; 2719 Clark Ave.	2541	832-6688
*Bengel, James E., Counselor, Counseling 207 Peele; 912 Weston St.	2424	828-8852
*Bennett, Landis S., In Charge, Visual Aids, Agri. Information 5 Ricks; 1320 Westfield Ave.	2861	833-6283
*Bennett, Lawton E., Instructor, History & Political Science 111 Harrelson; 1605 Beaver Dam Dr.	2481	833-6764
*Bennett, Melvin S., Administrative Secretary, Animal Science 123 Polk; 4206 Laurel Hills Rd.	2755	787-0108
*Bennett, Mitchell H., Agri. Res. Asst., Plant Pathology 7 Gardner; 705 Nellane Dr., Garner	2721	362-1216
*Bennett, Roy R., Extn. Prof., Crop Science 454 Williams; 2922 Barmettler St.	2641	TE2-1210
*Bennett, Thomasene M., Secretary, Agri. Mission to Peru 1 Patterson; 5017 Oak Park Rd.	2671, 2672	787-1348
*Bennett, Virgil L., Sergeant Major, USA, Military Science 154 Coliseum; 5730 Woodcrest Dr.	2428, 2672	834-3542
*Bennett, Willard H., Professor, Physics 201 Daniels; 5500 North Hills Dr.	2505	787-2173
*Benson, Jim A., Instructor, Crop Science 106 Williams; Rt. 5, Raleigh	2640	832-6707

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Bentley, Elizabeth T., Steno., Plant Pathology 113 Gardner; 5304 E. Lakeside Dr.	2737, 2735	834-5821
*Bentley, John W., Agri. Res. Superv., Crop Science 186 Williams; Yates Pond Rd., Rt. 4, Raleigh	2657	832-6247
*Berger, Jacques, Asst. Prof., Zoology 167 Gardner; 3613 Anclote Pl., Apt. E	2741	787-0935
*Bernard, Eugene E., Asst. Prof., Psychology 228 Tompkins; 707 West Morgan St.	2254	834-6201
Bernat, Sophia E., Statistical Clerk, Agri. Econ. 7 Patterson; 1835 Smallwood Dr.	2612	828-3244
*Berrier, Richard N., Res. Instructor, Textiles 15 David Clark Labs.; 820 Brent Rd.	2555	834-0143
Berry, Betty, Technician, Zoology 162 Gardner; 123 Woodburn Rd.	2741	832-7955
*Berry, Ernest B., Asst. Prof., Textiles 206 Nelson Textile; Box 155, Rt. 1, Raleigh	2568	834-4492
*Berry, Hardy D., Director, Information Services 202 Holladay; 2601 Wells Ave.	2874, 2875	VA8-2776
*Berry, James E., Instructor, Agri. Econ. 220 1911 Building; Rt. 4, Lake Wheeler Estates	2617	828-6338
*Best, Anne S., Statistical Clerk, Agri. Econ. 7 Patterson; 108 Ashe Ave.	2612	833-7769
*Best, Juanita Y., Key Punch Oper., Computing Center 11-G Nelson Textile; 708 Barksdale Dr.	2518	TE4-0543
Betts, Leonidas J., Instructor, English 7-9 Winston; 109 Ramblewood Dr., Tara Apts., #48	2461	787-3529
*Bhattacharyya, Bibhuti B., Asst. Prof., Experimental Statistics 604-A General Laboratory; 3003 Wade Ave.	2534	828-5282
*Bickford, Carlos P., Instructor, Soil Science 115 Williams; 107 Longleaf Dr., Wilmington	2654	
*Biggar, D. J., Instructor, Agri. Econ. 201-F Patterson; 212 Lafayette Rd.	2606	
Billingsley, E. Page, Secretary, Physical Plant 100 Morris; 2008-D Smallwood Dr.	2181	834-5079
*Bingham, Robert J., Asst. Prof., Food Science 128D Polk; 5019 Tanglewood Dr.	2794	787-1893
*Bingham, William L., Asst. Prof., Engr. Mechanics 349 Riddick; 5207 Dillard Dr.	2342	833-9634
*Bireline, George L., Assoc. Prof., Design 203 Brooks; 1020 W. South St.	2205	TE3-8033
*Bireline, Janice, Instructor, Physics 410 A General Laboratory; 1020 W. South St.	2513	TE3-8033
*Bishir, John W., Assoc. Prof., Mathematics 230 Harrelson; 376 Wilmot Dr.	2384	833-0975
*Bishop, Charles E., Professor & Head, Agri. Econ. 216 Patterson; 727 Runnymede Rd.	2619	833-4789
†Bishop, Dessie C., Secretary, Student Activities King Religious Center; 8 Bagwell Ave.	2414	834-0672
Bissette, Vanice K., Steno., Mathematics 255 Harrelson; 704 Boylan Dr.	2383	834-9955
Black, M. Jean, Extn. Housing & House Furn. Spec., Agri. Extn. 210 Ricks; 2512½ Clark Ave.	2785	834-3847
Blackburn, Rebecca J., Secretary, Agri. Econ. 18 Patterson; 207 N. Aiken St., Fuquay Springs	2664	MU7-4322
*Blackwood, Worth T., Jr., Chief Security Officer, Physical Plant 116 Morris; Rt. 5, Raleigh	2181	266-2054
*Blake, Carl T., Extn. Assoc. Prof., Crop Science 152 Williams; 5133 Jeffries Rd.	2639	832-1294

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
Blake, Henry W., Instructor, Engr. Mechanics 119 Riddick; Box 15508, N. C. State College	2343	
*Blake, William O., Agri. Res. Asst., Animal Science Animal Husbandry Farm; Rt. 8, Raleigh		828-4298
*Blalock, Doretha J., Typist, Acquisitions 112 Library; J-17 Washington Terrace	2841	828-5964
*Blalock, T. C., Professor, Animal Sci., Asst. Director, 4-H Club Work, Agri. Extn. 4-H Club 200 Ricks; 1315 Brooks Ave.	2801	834-2396
*Blalock, Thomas J., Asst. Prof., Chemistry 103 Withers; 3504 Churchhill Rd.	2549	TE3-9291
*Blanchard, Eleanor L., Photo Lab. Tech., Agri. Information 12 Ricks; 605 Buck Jones Rd.	2862	833-2145
*Blank, Philip E., Jr., Instructor, English 115 Winston; 3002 Warren Ave.	2464	832-2469
*Blanton, Mary Ann, Secretary, Agri. Econ. 18 Patterson; Rt. 5, Timberlake Estates	2664	832-1070
Blaylock, M. Loyce, Steno, Education 118 Tompkins; 1509 Caswell St.	2231, 2232	832-7038
*Bliss, Milton C., Asst. Director, Music 104 Pullen; 101 Dixie Tr.	2401	833-8994
*Block, William J., Professor, History & Political Science 111 Harrelson; 821 Ravenwood Dr.	2483	834-8353
*Blount, Samuel M., Jr., Area Coordinator, Industrial Extn. Ser. 1-B IES Building; 661 Cranbrook Rd.	2359	TE4-4375
*Blow, William L., Assoc. Prof., Poultry Genetics, Poultry Science 205 Scott; 304 Furches St.	2623	833-6806
*Blue, Henry D., Maintenance Superv., Erdahl-Cloyd Union Erdahl-Cloyd Union; 201 E. Franklin St.	2453, 2451	834-7544
*Blum, George B., Jr., Asst. Prof., Agri. Engr. 150 Agri. Engr.; 1408 Walnut Tr.	2662	TE4-1578
*Blumer, Thomas N., Professor, Food Science 203 Polk; 350 Meredith St.	2778	TE4-3593
*Boal, R. S., Extn. Assoc. Prof., Extn. Economist, Agri. Econ. 18-A Patterson; 121 West Sycamore, Wake Forest	2664	395-3236
*Boaz, Joseph N., Assoc. Prof., Architecture 200-E Brooks; 3309 Milton Rd.	2204	TE2-1235
*Bogdan, John F., Professor, Textiles 107 Nelson Textile; 2120 Ridge Rd.	2569	787-4402
*Boland, Cathryn W., Accounting Clerk, General Extn. 117 1911 Building; 5014 Tanglewood Dr.	2261, 2262, 2267	787-1617
*Bolick, Harold G., Grounds Supt., Physical Plant 1 Morris; 5007 Western Blvd.	2181	828-5791
*Bonardi, Roberta T., Accounting Clerk, Payroll, Bus. Affairs 206 Holladay; Route 4, Sanford	2151, 2152	776-3118
*Boone, Edgar J., Asst. Dir. & Head, Extn. Personnel Develop. 109 Ricks; 4918 Rembert Dr.	2818, 2819	787-3486
*Boone, Ruth S., Secretary, Philosophy & Religion 344 Harrelson; 3602 Phyllis Dr.	2477	834-2584
*Borth, Betty W., Nurse, Student Health Service Clark Infirmary; 3103 Devonshire Rd.	2410	832-5117
*Bostian, Carey H., Professor, Genetics 348 Gardner; 1000 Lake Boone Tr.	2732	832-3600
*Bowden, Harriett D., Steno., Soil Science 226 Williams; 2608½ Vanderbilt Ave.	2643	833-8640
*Bowen, Henry D., Professor, Agri. Engr. 157 Agri. Engr.; 3400 Octavia Rd.	2662	834-5479

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
Bowen, Lawrence H., Asst. Prof, Chemistry 311 Withers; 2008 Smallwood Dr.	2524	TE4-0046
*Bowers, Henry, Director, Erdahl-Cloyd Union Erdahl-Cloyd Union; 3426 Bradley Pl.	2451, 2452	834-7079
*Bowles, Hugh C., Placement Officer, Agri. and Life Sciences 112 Patterson; 1408 Walnut Tr.	2668	828-9433
*Bowles, Patsy M., Clerk, Admissions & Registration 12-C Peele; 1408 Walnut Tr.	2434	828-9433
*Bowman, Shelby E., Key Punch Oper., Admissions & Registration 4 Peele; 2501 Glascock St.	2432	834-5985
*Bowman, Worth B., II, Reactor Engr., Nuclear Reactor Project 24 Burlington Nuclear Lab.; 1213 Manchester Dr.	2321	787-1296
*Bradford, Edward H., Assoc. Prof., Textiles 142-A Nelson Textile; 4120 Galax Dr.	2565	787-1600
*Bradford, Garnett L., Instructor, Agri. Econ. 10A Patterson; 721 Shelley Rd.	2603	787-0458
Brady, Robert A., Programmer, Computing Center 11-E Nelson Textile; Apt. 1, 10 Enterprise St.	2510	834-8096
Bramer, Charles R., Professor & Acting Head, Civil Engr. 208 Mann; 2729 Oberlin Rd.	2331	833-0058
*Branch, Samuel D., Electronics Tech., Agri. Engr. 117 Agri. Engr.; 511 Morningside Dr., Cary	2681	
*Brandt, Bartholomew B., Prof. Emeritus, Zoology 155 Gardner; 3218 Bedford Ave.	2741	833-7009
*Brant, Dorothy L., Instructor, Mathematics 333 Harrelson; 2404 Beechridge Rd.	2386	TE2-7791
*Brantley, Ann T., Key Punch Oper., Animal Science Dairy Records Processing Center—Leazar; 1409 Kelly Rd., Garner	2632	362-9277
*Brantley, Herbert, Instructor, Rec. & Park Admin. 103-D Field House; 3213 Glenridge Dr.	2247	VA8-4749
*Brantley, Peggy Y., Steno., Crop Science 428 Williams; Rt. 1, Box 747, Cary	2642	467-1349
*Brantley, Vestor R., Asst. Prof., Mathematics 336 Harrelson; 152 Jones-Franklin Rd.	2386	833-0022
*Branum, Ruby B., Steno., Math. & Science Ed. & Occupational Info. & Guidance 103 Tompkins, 208 Tompkins; 1419 Franklin Rd.	2239, 2244	TE4-2918
Brasfeild, Helen M., Agri. Res. Asst., Genetics 29b Gardner; 207-B Park Ave.	2734	828-4946
*Braswell, Charles C., Buildings Supt., Physical Plant 4 Park Shop; 3500 Sloan Ct.	2181	828-7113
*Braswell, Edward E., Draftsman, Agri. Engr. 212 Agri. Engr.; 900 Merrie Rd.	2677	828-4676
*Braswell, Julia H., Clerk, Admissions & Registration 7 Peele; 3500 Sloan Ct.	2435	828-7113
*Brawley, Joel V., Jr., Instructor, Mathematics 318 Harrelson; 1530 College Rd.	2386	VA8-6379
*Bredenberg, Paul A., Professor, Philosophy & Religion 347 Harrelson; 1600 Crump Rd.	2477	834-5352
*Brett, Charles H., Professor, Entomology 238 Gardner; 1425 Dixie Tr.	2745	832-4596
Breunig, John, Catholic Chaplain, Student Affairs King Religious Center; Box 185, Wendell	2414	FO5-7114
*Brewbaker, Carey L., Asst. Football Coach, Athletics 115 Coliseum; 2512 Clark Ave.	2101	834-4131
*Brickell, Robert V., Instructor, Social Studies 157 Harrelson; 2533 Remington Rd.	2479	TE3-9578

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Bridge, Gladys G., Clerk, Registration 7 Peele; Wake Forest	2435	556-3525
Bridgers, Eleanor F., Steno., Mechanical Engr. 211 Broughton; Kenly, N. C.	2365, 2366	284-3179
†Bridges, William S., Assoc. Prof. Emeritus, Mechanical Engr. 125 Chamberlain St.		TE2-4159
*Briggs, Hermon B., Prof. Emeritus, Mechanical Engr. Black Mountain, N. C.		
Briggs, Mary M., Steno., Crop Science 156 Williams; G-1 Raleigh Apts.	2657	TE2-7156
*Bright, H. Ray, Engineer, ETV Educational Television Studio, Western Blvd.; 4811 Montacute St.	2853	828-8608
*Bright, Richard, Professor, Chemical Engr. 107 Riddick; Rt. 7, Raleigh	2325	833-3331
*Brim, Charles A., Res. Professor, Crop Science 112 Williams; 1713 Nottingham Rd.	2638	787-4233
*Brinkley, Sherrill K., Asst. Director, Alumni Affairs 109 Alumni; 5437 Penwood Dr.	2869, 2860	832-5473
*Brinkley, Susan P., Statistical Analyst, Genetics 343-F Gardner; 5437 Penwood Apts.	2704	832-5473
*Britson, Janice Y., Steno., Engr. Mechanics 324 Riddick; 2707 Grant Ave.	2341, 2342	828-2839
Britt, Ramon P., Res. Assoc., Food Science 16 Polk; 3302 Hall Pl.	2777	833-1397
*Britt, Southgate T., Agri. Res. Superv., Soil Science 362 Williams; 808 Colleton Rd.	2649	TE4-1949
*Britt, Virginia D., Steno., Genetics 343-A Gardner; 2710 W. Rothgeb Dr.	2704	832-5096
*Brockman, Grace W., Res. Superv., Poultry Science 228 Scott; 2612 Clark Ave.	2623	834-1800
*Bronson, Dewey J., Farm Hand, Animal Science Central Research Station, Western Blvd.; Rt. 8, Raleigh	2680	
*Brooks, Joe F., Extn. Instructor, Horticultural Science 227 Kilgore; 426 Pleasants Ave., Cary	2686, 2687	467-1184
*Brooks, Lorraine C., Typist, Physical Plant 111 Morris; Rt. 3, Lake Wheeler Rd.	2181	828-9488
*Brooks, Loretta S., Clerk, Print Shop Print Shop; P-218 McKimmon Village	2132	834-0554
*Brooks, R. Charles, Extn. Instructor, Extn. Economist, Agri. Econ. 209-C Patterson; 408 Willow St., Cary	2618	HO7-9455
*Brose, King R., Res. Assoc., Engr. Research 143D Riddick; 370 Wilmot Dr.	2349	834-0701
*Brown, Burnelle H., Steno., Textiles B-50 Nelson Textile; 324-A Dacian Rd.	2558	VA8-9665
*Brown, Edmond J., Asst. Prof., Physics 406 E General Laboratory; 1321 Franklin Rd.	2515	TE3-1168
*Brown, Evelyn A., Typist, Acquisitions 112 Library; J-23 McKimmon Village	2841	833-7350
*Brown, Harlan C., Assoc. Director, Library 301 Library; 3217 Merriman Ave.	2843	TE3-4484
*Brown, Henry S., Assoc. Prof., Geological Engr., Mineral Ind. 207 Page; 3439 Redbud Ln.	2378	TE2-0063
†Brown, Jean C., Agri. Res. Tech., Genetics 350 Gardner; 2715 Kilgore St.	2733	834-9023
Brown, Julia D., Steno., Nuclear Engr. 4 Burlington Nuclear Labs.; 1109 Nichols Dr.	2302	828-5339
*Brown, Kenneth A., Draftsman, Textiles B-5D Nelson Textile; 1215 Watauga St.	2566	832-2742

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Brown, Luther E., Agri. Res. Superv., Soil Science 105 Williams; 432 Rose Ln.	2643	833-6072
*Brown, Marvin L., Jr., Professor, History & Political Science 106 Harrelson; 2948 Claremont Rd.	2481	834-7688
*Brown, Ruby E., Nurse, Student Health Service Clark Infirmary; 1202 Kent Rd.	2410	833-9988
*Brown, Talmage T., Assoc. Prof., Poultry Science 126 Scott; 1709 Bickett Blvd.	2627	832-9731
Brown, Walter J., Loan Administrator, Business Affairs B Holladay; Box 514, YMCA, Hillsboro St.	2144	TE2-6601
Browne, Cicely C., Res. Tech., Forest Management 254 Kilgore; 1009 Dixie Tr.	2880	832-5201
*Bruce, Wesley G., Visiting Prof., Entomology 337 Gardner; 4218 Lambeth Dr.	2748	787-2487
*Bryan, Robert P., Asst. Editor, Agri. Information 315 Ricks; 401 Roxanne Dr.	2806, 2809	832-4383
*Bryan, Sudie, Agri. Res. Asst., Crop Science 122 Williams; Rt. 1, Garner	2638	EM2-9468
*Bryant, C. Douglas, Asst. Prof., Agri. Education 123 Tompkins; 921 Warren Ave., Cary	2234	467-1759
*Bryant, Kenneth M., Asst. Basketball Coach, Athletics 102 Coliseum; 401 N. Glenn Dr.	2105	
*Bryant, Ralph C., Professor, Forest Management 150 Kilgore; 4516 Avent Ferry Rd.	2885	833-0535
*Buchanan, James S., Extn. Prof., Extn. Animal Husb. Spec., Animal Sci. 111 Polk; 2622 Grant Ave.	2762	834-3480
*Buck, James H., Sergeant, USA, Military Science 154 Coliseum; 905 Carlisle St.	2428	834-3480
Buckley, Nancy, Statistical Clerk, Agri. Econ. 205 Patterson; 2759-D Milburnie Rd.	2724	834-8994
*Buffaloe, Mary H., Steno, General Extension 124 1911 Building; 606 Nellane Dr., Garner	2261, 2262, 2267	EM2-1177
*Bulla, Marilyn R., Clerk, Counseling 205 Peele; 3601 Swann Dr.	2421	787-0646
*Bullard, William C., Sergeant, USA, Military Science 154 Coliseum; 124 Hawthorne Rd.	2428, 2429	833-9351
*Bullock, Roberts C., Professor, Mathematics 241-a Harrelson; 1415 Dixie Tr.	2384	832-7127
*Bumgardner, Carl L., Assoc. Prof., Chemistry 102 Withers; 4304 Galax Dr.	2549	787-3603
*Bumgardner, Harvey L., Extn. Assoc. Prof. in Poultry, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Bunch, Luther V., Agri. Res. Asst., Crop Science 182 Williams; Rt. 8, Raleigh	2657	787-0767
*Bunn, Clara R., Agri. Res. Superv., Animal Science 339 Polk; 1826 Glenwood Ave.	2773	828-5700
Bunn, Mary Lou, Steno., Civil Engr. 208 Mann; 623 Glascock St.	2331	828-8630
*Burnette, B. L., Stockroom Supervisor, Chemistry 26 Withers; Rt. 3, Raleigh	2547, 2539	828-8661
*Burnette, W. Haywood, Maintenance Man, Industrial Engr. Park Shop; Apex	2361	EL4-6672
*Burns, Lt. J. M., USN, NESEP Administrative Officer, Elec. Engr. 333 Daniels; 904 Vernon St., Garner	2897	362-1241

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
Burns, Joyce A., Agri. Res. Superv., Crop Science 484 Williams; Doyle Dr., Rt. 8, Raleigh	2644	787-2563
*Burt, Excell, Nursery Worker, Horticultural Science Horticultural Lab., Method; Rt. 1, Apex	2823	
*Busta, Francis F., Asst. Prof., Food Science 128B Polk; 213C Bragaw Dorm, N. C. State, Box 15075	2794	828-5139
Butler, Eleanor M., Accounting Clerk, Crop Science 254 Williams; 1063 Nichols Dr.	2648	TE3-0001
*Butler, Ronald C., Asst. Dir. for Adm., Admissions & Registration 112 Peele; 544 Cooper Rd.	2431	832-1800
*Byrd, Betty S., Steno., Engr. Research 124 Riddick; Rt. 1, Garner	2346	362-9267
*Byrd, Billy R., Agri. Res. Asst., Food Science 136 Polk; Box 658, Wendell	2795	365-5632
*Byrd, DeWitt, Jr., Agri. Res. Asst., Plant Pathology 102 Gardner; Rt. 1, Wendell	2736	FO5-5497
*Byrd, Peggy N., Steno., General Extension 121 1911 Building; Rt. 1, Box 573, Clayton	2261	922-6524
*Byrd, Thomas M., Assoc. Editor, Agri. Information 314 Ricks; 903 Washington St., Cary	2805, 2809	467-9848

C

*Cahall, Robert M., Asst. Shops Supt., Physical Plant 3 Park Shop; 2335 Lyon St.	2181	832-6678
*Cahill, Fred V., Dean, Liberal Arts 162 Harrelson; 4801 Yadkin Dr.	2467, 2468	787-2838
*Caldwell, Ann C., Accounting Clerk, Agri. & Life Sciences 120-H Patterson; 2817 Fowler St.	2714, 2715	VA8-5239
*Caldwell, John T., Chancellor, Chancellor's Office "A" Holladay; 1903 Hillsboro St.	2191	828-6642
*Callis, John M., Agri. Res. Asst., Crop Science 453 Williams; P. O. Box 62, Willow Springs	2642	687-5137
Cameron, Charlotte S., Steno., Admissions 105 Peele; 540 N. Blount	2433	834-7624
*Camp, Allene M., Nurse, Student Health Service Clark Infirmary; 3210½ Clark Ave.	2410	833-6078
*Campbell, D. Graham, Data Proc. Mgr., Business Affairs 2 Holladay; 2719 Oberlin Rd.	2140	VA8-4642
*Campbell, Henry F., Agri. Res. Asst., Crop Science 180 Williams; Rt. 4, Raleigh	2657	833-0161
*Campbell, Kenneth S., Professor, Textiles 103 David Clark Labs.; 1720 Nottingham Rd.	2552	787-4659
*Campbell, Malcolm E., Dean, Textiles 101 Nelson Textile; 1315 Williamson Dr.	2575, 2576	TE3-3971
*Campbell, William V., Assoc. Prof., Entomology 335 Gardner; 4312 Galax Dr.	2748	787-1417
*Canaday, Emmett J., Asst. Prof., Mathematics 213 Harrelson; 2611 Wade Ave.	2381	TE3-7025
*Cannon, Anne W., Agri. Res. Asst., Animal Science 340 Polk; 1212 Chaney Rd.	2773	828-3059
*Cannon, Hugh, Instructor, Social Studies 148 Harrelson; 163 Pasquotank Dr.	2479	787-2798
†Cannon, Isabella W., Steno., Library 130 Library; 212 Brooks Ave.	2843	TE4-6017
*Cannon, Thomas F., Assoc. Prof., Horticultural Science 132 Kilgore; 1212 Chaney Rd.	2683	828-3059

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Capel, George L., Extn. Prof. In Charge, Extn. Mkt. Econ., Agri. Econ. 212 Patterson; 4122 Rockingham	2602	787-0668
†Capps, Vera H., Steno., Agron. Extn., Crop Science 128 Williams; 305 Cedar St.	2639	834-5560
Caraway, Thelma J., Asst. Prof., Mathematics 326 Harrelson; 3700 Bellevue Rd.	2386	828-8744
*Carell, Edgar F., Visiting Asst. Prof., Botany & Bacteriology 246 Gardner; Arbor Villa, Apt. #9, Cary	2726	467-3852
*Carlsen, Polly A., Steno., Plant Pathology 103 Gardner; 317 Spring Ave., Fuquay Springs	2736	687-4914
*Carmichael, Halbert H., Asst. Prof., Chemistry 20A Withers; 1001 Marlborough Rd.	2548	832-4128
*Carnesale, A., Instructor, Nuclear Engr. 235 Riddick; 508 Poplar Dr., Echo Heights	2304	828-3029
*Carnesale, Janet H., Administrative Secretary, Business Affairs 109 Holladay; 508 Poplar Dr.	2145	828-3029
Carney, Becki, Library Asst., Reference 122 Library; 322-J Dacian Rd.	2844	833-8760
*Carpenter, William L., Head, Agri. Information 117 Ricks; 628 S. Lakeside Dr.	2807, 2800	832-3361
*Carr, Captain Robert F., USA, Asst. Prof., Military Science 154 Coliseum; 1221 Kimberly Dr.	2428, 2429	787-2687
Carraway, Mary H., Clerk, Psychology 201 Tompkins; 2706 Everett Ave.	2251, 2252	832-5457
*Carrington, Mary F., Agri. Res. Asst., Food Science Basement Kilgore; 221 Reynolds Rd.	2691, 2692	787-3905
*Carroll, Adger B., Instructor, Agri. Econ. 16 Patterson; 2335 Grant Ave.	2603	828-8193
*Carroll, Carl L., Agri. Res. Asst., Genetics 345 Gardner; 2851 Rock Quarry Rd.	2734	828-2956
Carroll, Frances P., Res. Tech., Horticultural Science 203 Kilgore; Rt. 2, Clayton	2660	WA2-6518
*Carroll, Warren, Field Director, Wolfpack Club 108 Coliseum; 709 Yarmouth Rd.	2112	787-2361
*Carson, Robert G., Jr., Assoc. Dean, Engineering 232 Riddick; 1202 Brooks Ave.	2316	833-4964
*Carter, Carol B., Statistical Clerk, Crop Science 139-B Williams; 1821 Stillwater Dr.	2638	787-4530
*Carter, Charlotte T., Steno., Physics 103 General Laboratory; 224 Chamberlain St.	2521, 2522	828-6631
*Carter, Larry A., Agri. Res. Asst., Plant Pathology 13 Gardner; 2420 Franklin Rd.	2711	TE4-3330
*Carter, Roy M., Professor, Wood Sci. & Tech. 158 Kilgore; 1821 Stillwater Dr.	2883	787-4530
*Carter, Sue C., Steno., Soil Science 222 Williams; 3714 Halford Dr.	2655	834-8166
*Caruolo, Edward V., Asst. Prof., Animal Science Animal Disease Lab.; 407 Dorothy Dr., Cary	2738, 2739	467-1766
*Carver, Irvin L., Res. Superv., Horticultural Science Horticultural Lab., Method; Rt. 1, Apex	2823	354-4044
Case, Everett N., Head Basketball Coach, Athletics 104 Coliseum; 611 Daniels St.	2105	833-4772
*Casey, Willis R., Swimming Coach, Athletics 122 Coliseum; 1605 Park Dr.	2101	833-6694
*Cassell, Guy R., Extn. Assoc. Prof., Extn. Economist, Agri. Econ. 18-B Patterson; 372 Wilmot Dr.	2664	833-4162

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Cate, R. B., Jr., Visiting Asst. Prof., Soil Science (AID) 101 Williams; USAID/ARD, APO 676, New York, N. Y.	2630	
*Cates, David M., Professor, Textile Chemistry 3 David Clark Labs.; 1807 Manuel St.	2551	787-2488
*Cathey, Robert E., Agri. Res. Asst., Animal Science Nutrition Barn, Central Station, Western Blvd.; 3532 Western Blvd.	2709	828-2717
*Cato, Phillip C., Episcopal Chaplain, Student Affairs King Religious Center; 1715 Hillsboro St.	2414	834-2394
*Cell, John W., Professor & Head, Mathematics 252 Harrelson; 3114 Darien Dr.	2382, 2383	TE2-2528
*Chadwick, Dorothy B., Steno., N. C. Crop Improvement 189 Williams; 3321 Ridge Dr.	2851	832-2759
*Chalfant, R. B., Asst. Prof., Entomology 1230 Pine Brook Cir., Hendersonville		693-3167
*Chambers, Everett E., Asst. Prof., Horticultural Science 128 Kilgore; 4003 S. Juniper Ct.	2683	787-1271
*Chamblee, Douglas S., Professor, Crop Science 192 Williams; 3359 Hampton Rd.	2657	787-0103
*Champion, Hubert M., Jr., Mechanic, Research Shop, Agri. Engr. 130 Agri. Engr.; 1408 Courtland Dr.	2681	TE3-4034
*Champion, Larry S., Asst. Prof., English 115 Winston; 4106 Laurel Ridge Dr.	2464	787-3072
*Chansky, Norman M., Assoc. Prof., Education 117 Tompkins; 401 Brooks Ave.	2232	TE4-3549
*Chapman, Marylan M., Typist, Admissions & Registration 11 Peele; Rt. 1, Box 552-F, Cary	2436	467-1480
*Chappell, Joe S., Asst. Prof., Agri. Econ. 3-B Patterson; Rt. 3, Varina	2612	687-2890
*Christian, Erich, Adjunct Professor, Electrical Engr. 4201 Windsor Pl.		787-2653
*Christian, John A., Extn. Prof., Food Science 201 Polk; 310 Meredith St.	2778	TE4-0291
*Clapp, John G., Extn. Instructor, Crop Science 152 Williams; 2306 Hales Rd.	2639	833-4020
Clark, E. W., Adjunct Asst. Prof., USDA, Entomology Box 2086, Durham		
*Clark, George D., Manager, N.R.R.C. 505 Oberlin Road, Room 100; 816 Greenwich St.	2866	833-9640
*Clark, J. Edwin, Instructor, Civil Engr. 316 Mann; 1132 Gorman St.	2333	833-6330
*Clark, Joseph D., Prof. Emeritus, English 117 Winston; 15 Furches St.	2464	832-7385
Clark, Margaret E., District 4-H Club Agent, Agri. Extn. 206 Ricks; 2806 Anderson Dr.	2802, 2803	TE4-2376
*Clark, Major Virgil S., USAF, Asst. Prof., Aerospace Studies 145 Coliseum; 5804 Deblyn Ave.	2417, 2419	787-3025
*Clarke, A. H., Director of Dining Services, A.R.A. Slater Leazar Hall; 4617 Woodridge Dr.	2879, 2877	787-1517
*Clarke, Lewis J., Professor, Landscape Architecture 217 Brooks; 3008 Rothgeb Dr.	2204	TE3-0407
*Clarkson, Helen P., Instructor, Soc. & Anthro. 355 Harrelson; 400 Fletcher Dr.	2491	828-2832
*Clarkson, John M., Professor, Mathematics 223 Harrelson; 2605 Clark Ave.	2385	832-8762
*Clawson, Albert J., Assoc. Prof., Animal Science 213 Polk; 325 Meredith St.	2763	832-1679
*Clayton, Carlyle N., Professor, Plant Pathology 7 Gardner; 2607 Van Dyke Ave.	2721	832-1363

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Clayton, Maurice H., Assoc. Prof., Engr. Mechanics 317 Riddick; 1307 Brooks Ave.	2343	TE3-2028
*Clements, John L., Asst. Prof., Physical Education Carmichael Gymnasium; 2233 Dixie Tr.	2487	787-4709
*Clifton, Nell C., Secretary, Extn. Personnel Development 109 Ricks; 3104 Georgian Ter.	2818, 2819	828-4553
*Clogston, Roy B., Director, Athletics & Wm. Neal Reynolds Coliseum, Athletics 105 Coliseum; 2503 Glenwood Ave.	2101	832-4124
*Cloninger, Sally D., Secretary, Graduate School 104 Peele; 909 Merrie Rd.	2872	828-3109
*Cloyd, E. L., Dean of Students Emeritus 2224 Hillsboro St.		TE2-5983
*Cobb, Grover C., Asst. Prof., Physics 406D General Laboratory; 512 Princeton St.	2515	787-4619
*Cobb, John W., Lutheran Chaplain, Student Affairs 2723 Clark Ave.; 1417 Regent Pl.	832-9687	832-0072
*Cochran, Fred D., Professor & Head, Horticultural Science 118 Kilgore; 2620 Churchill Rd.	2684	TE4-2013
*Cockerham, C. Clark, Professor, Experimental Statistics 608E General Laboratory; 2110 Dixie Tr.	2534	787-4844
Cofer, Eloise S., Professor, Food Science, Asst. Director In Charge, Home Economic Programs, Agri. Extn. 101-A Ricks; 1507 Caswell St.	2781, 2782	834-0825
*Coffey, Joseph D., Visiting Instructor in Agri. Economics, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
Coffin, Christine, Library Asst., Circulation Library; 2910 O'Berry St.	2845	
*Coffindaffer, William L., Agri. Res. Superv., Animal Science Fincrest Farm; Miss Penny Rd.	2759	
*Coggin, James K., Prof. Emeritus, Agr. Education 326 S. Harrison Ave., Cary		
Coggin, Mary, Statistical Clerk, Agri. Econ. 7 Patterson; 2717 Glenwood Ave.	2612	787-2049
*Cole, Colleen M., Administrative Secretary, Institute of Biol. Sci. 101 Patterson; 2709 Rothgeb Dr.	2665	833-4096
Cole, Mary G., Secretary, Agri. Extn. 213 Ricks; 16 Horne St.	2786	828-6776
*Cole, Sarah F., Textile Res. Tech., Textiles 204 Nelson Textile; 3900 Avent Ferry Rd.		833-3535
*Coleman, Lt. Col. David J., Jr., USA, Asst. Prof., Military Science 154 Coliseum; 800 Macon Pl.	2428, 2429	787-2184
*Coleman, James R., Instructor, Social Studies 156 Harrelson; 324 W. King St., Hillsboro	2479	732-2467
*Collins, Emerson R., Extn. Prof., In Charge, Agron. Extn., Crop Science 252 Williams; 2713 Rosedale Ave.	2653	TE2-9715
*Collins, John N., Extn. Inst., Com. Devel. Spe., Rural Soc. 238 1911 Building; 518 E. Academy St., Fuquay Springs	2659	687-5748
*Collins, Herbert, Asst. Prof., Soc. & Anthro. 315 Harrelson; 1400 Kent Rd.	2491	TE4-6128
*Combs, Joseph J., University Physician, Student Health Service Clark Infirmary; 2125 White Oak Rd.	2410	832-4381

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Compton, William A., Visiting Asst. Prof. in Genetics, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Congleton, Verlia S., Key Punch Oper., Animal Science Dairy Records Processing Center—Leazar; 411 Avery St., Garner	2632	362-9609
*Connell, Myrtle N., Typist, Erdahl-Cloyd Union Erdahl-Cloyd Union; 2711 Cooleemee Dr.	2453, 2451	834-4791
Connelly, Richard P., Instructor, Electrical Engr. 225 Daniels; 204 Furches St.		834-8000
*Conner, Norval W., Director, Engr. Research 127 Riddick; 3006 Ruffin St.	2345, 2346	832-4924
*Conover, Richard D., Visiting Extn. Instructor in Animal Science, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
Cook, Carol L., Secretary, Economics 120 Harrelson; 10 Montgomery St., Apt. 3	2472	828-3782
Cook, Freeman W., Assoc. Prof., Poultry Path., Poultry Science 118 Scott; 1621 Park Dr.	2624	833-4449
*Cook, Hilliard D., Asst. Prof., Pulp & Paper Tech. 106 Robertson Lab.; 806 Williamson Dr.	2889	TE2-6320
*Cook, John O., Professor, Psychology 220 Tompkins; 3413 Churchill Rd.	2252	834-7094
Cook, Maurice G., Asst. Prof., Soil Science 228 Williams; 2101-B Van Dyke Ave.	2643	833-4445
Cook, Rodney E., Secretary, Agri. Econ. 4-B Patterson; P. O. 12272 Cameron Village Sta.	2607	834-3360
*Cooke, Annie P., Tel. Oper., Tel. Exch. 116 Winston; 2021 Fairview Rd.	0	832-1419
*Cooke, Henry C., Assoc. Prof., Mathematics 206 Harrelson; 3350 Hampton Rd.	2381	787-4815
*Cooke, Joan O'N., Clerk, Admissions 107 Peele; Route 4, Zebulon	2433	269-9309
*Cooper, Arthur W., Assoc. Prof., Botany & Forestry, Botany & Bacteriology 261 Gardner; 2640 Davis St.	2725	833-6358
*Cooper, Bea, Secretary, USDI-Zoology 218-H David Clark Labs.; 919 Jones Ave.	2856	834-7753
*Cooper, Nelvin E., Asst. Prof., Physical Education Carmichael Gymnasium; 711 Dorsett Dr., Cary	2487	HO7-9741
*Cooper, William E., Assoc. Prof., Plant Pathology 211 Gardner; 919 Jones Ave.	2751	834-7753
*Coots, Alonzo F., Assoc. Prof., Chemistry 311 Withers; 1517 Duplin Rd.	2538	TE4-3796
*Cope, Ralph L., Asst. Prof., Industrial Engr. Park Shop; 807 Chamberlain St.	2361	TE2-2673
*Cope, Will A., Assoc. Prof., Crop Science 162 Williams; 1615 Jones Ave.	2657	833-6392
*Corbin, Frederick T., Res. Asst., Crop Science 457 Williams; Rt. 6, Box 91, Raleigh	2642	787-3232
*Cordrey, Carolyn, Agri. Res. Asst., Animal Breeding, Animal Science 10 Polk; 811 Tower St.	2768	833-0841
*Cornish, Robert M., Instructor, Social Studies 157 Harrelson; 2130 Cowper Dr.	2479	TE2-1965
*Cornell, Franklin E., Asst. Prof., Horticultural Science 228 Kilgore; 3207 Leonard St.	2669	TE4-4542

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Corter, Harold M., Professor, Psychology 223 Tompkins; 3211 Arthur Ct.	2253	833-9370
Cosgrove, John H., Instructor, Chemical Engr. 208 Riddick; 1417 Jackson St.	2326	828-8758
†Coston, Reba C., Typist, Registration 7-A Peele; C-8 Wilmot Apts., 3200 Hillsboro St.	2435	833-7246
*Cothren, Jimmie Lou, Library Asst., Serials 12 Library; Box 324, Cary	2842	467-1680
*Cotton, C. Isaac, Agri. Res. Asst., Animal Science Nutrition Barn, Central Station, Western Blvd.; Box 33, Method	2709	832-4767
*Cotton, David, Farm Hand, Animal Science Central Res. Station, Western Blvd.; Method	2680	
*Cotton, Earlie, Farm Hand, Animal Science Central Research Station, Western Blvd.; Method	2680	
*Council, Robbie R., Secretary, Extn. Entomology 141 Gardner; 1126 Brighton Rd.	2703	834-9919
*Council, Sarah B., Agri. Res. Asst., Genetics 350 Gardner; 502 Heater St., Cary	2733	467-9847
*Coutu, Arthur J., Professor in Agri. Economics, Chief, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Covington, Henry M., Extn. Prof., Horticultural Science 233 Kilgore; 203 S. Salem, Cary	2686, 2687	354-6160
*Covington, Tom L., Jr., Asst. Director, Student Activities 204 Peele; 206 Hillcrest Rd.	2442	834-9652
*Coward, Stuart D., Industrial Specialist, Industrial Extn. Service 2 IES Building; 5121 Wickham Rd.	2356	828-4850
*Cox, Carolyn R., Statistical Clerk, Agri. Econ. 7 Patterson; 2329 Grant Ave.	2612	834-2674
*Cox, Charles E., Instrument Maker, Textiles B-37 Nelson Textile; 1510 Lorimer Rd.	2559	833-5367
*Cox, Daisy M., Multilith Operator, Textiles 122 Nelson Textile; 800 Ravenwood Dr.		TE2-1940
*Cox, Fred R., Asst. Prof., Soil Science 382-A Williams; 5010 Dunbar Rd.	2649	TE2-6209
*Cox, Joseph H., Professor, Design 301 Brooks; 1132 Walnut Tr.	2205	TE4-3331
*Cox, Lydia L., Secretary, Animal Science Dairy Records Processing Center, Leazar; 327 Dacien Rd.	2632	
*Cox, Paul M., Maintenance Mech., Textiles B-42 Nelson Textile; 800 Ravenwood Dr.	2558	832-1940
*Coxe, Mary Frances, Steno.-Clerk, Rural Soc. Extn. 329 1911 Building; 3326 Ruffin St.	2701	833-8503
*Crabtree, Bertha L., Agri. Res. Tech., Soil Science 357 Williams; 4833 Fayetteville Rd.	2649	828-7895
Craddock, Anne, Secretary, School of Design 200 Brooks; H-5 Grosvenor Gardens	2202	TE2-2541
Craig, Doris L., Asst. Prof., Soil Science 327-A Williams; 827 C Daniels St.	2636	833-7383
*Craig, Frank R., Professor, Poultry Pathology, Poultry Science 109 Scott; 503 Northwood Cir., Garner	2624	EM2-9185
*Craig, Harris B., Assoc. Prof., Food Science 202 Polk; 3405 Ocotea St.	2778	787-4638
†Cranor, Winifred H., Res. Instructor, Textiles 1 David Clark Labs.; 2718 Bedford Ave.	2563	TE3-1318
*Crawford, Albert R., Asst. Prof., Rec. & Park Admin. 105-B Field House; 214 S. King Charles Rd.	2247	TE3-8838

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Crawford, John W., Extn. Prof., In Charge, Com. Dev., Rural Soc. 240 1911 Building; 719 Beaver Dam Rd.	2659	TE2-5050
*Crawford, Ora J., Administrative Secretary, Agri. Admin. 107 Patterson; 2209 Sheffield Rd.	2717	832-3606
*Crenshaw, Josephine D., Steno., Plant Pathology 207 Gardner; 2325 Woodrow Dr.	2751, 2752	787-1459
Cress, Janice L., Steno., Business Affairs 106 Holladay; 2759-D Milburnie Rd.	2146, 2147	TE4-8994
*Cribbins, Paul D., Assoc. Prof., Civil Engr. 423 Mann; 305 Griffis St., Cary	2333	467-9587
*Crocker, Sarah H., Sec., Engr. Mechanics 324 Riddick; 2900 Oberlin Rd.	2341, 2342	834-3054
*Crook, Bette M., Secretary, Nuclear Reactor Project 32 Burlington Nuclear Lab.; 230 W. Durham Rd., Cary	2321, 2322	467-4741
*Croom, Aldith A., Steno., Extn. Animal Husbandry 117 Polk; 4701 Brookhaven Dr.	2761	787-3539
*Croom, Ruth S., Secretary, Mineral Industries 109 Page; Rt. #1, Knightdale	2377	CO6-2191
*Crouch, Vaughn P., Agri. Res. Tech., Genetics 345 Gardner; 312 Olive St., Box 666, Apex	2734	354-6420
*Crow, Johnny L., Instructor, Freshman Engineering Division 273 Broughton; 3410 Avent Ferry Rd.	2387	828-7636
Crowder, James U., Instructor, Engr. Mechanics 119 Riddick; 1037 St. Mary's St.	2343	834-3724
*Crowell, Tamera S., Textile Lab. Tech., Textiles B-45 Nelson Textile; Apt. C-26 McKimmon Village	2558	
*Crump, Kelly R., Instructor, Freshman Engineering Division 277 Broughton; Route 4, Holly Springs Rd.	2387	TE3-7680
*Crump, Patsy R., X-ray & Lab. Tech., Student Health Service Clark Infirmary; Rt. 4, Holly Springs Rd.	2410	833-7680
†Crumpler, Frankie B., Secretary, Chemical Engr. 113 Riddick; 2307 Byrd St.	2324	832-6796
Cullins, Marie K., Secretary, Agri. Econ. 216 Patterson; 2421 Hickory Rd.	2619	834-4752
*Cullison, William E., Instructor, Economics 134 Harrelson; 3700 Avent Ferry Rd.	2472	828-7920
*Cummings, George A., Asst. Prof., Soil Science 362-A Williams; 1532 Delwood Dr.	2649	787-4244
Cummings, Paul, Jr., Agr. Res. Asst., Crop Science 430 Williams; 6309 Hillsboro Rd.	2642	
*Cunningham, Vernon, District Agent, USDI-Zoology 218-H David Clark Labs.; 5015 Newcastle Rd.	2856	828-6596
Currin, Nancy Lee, Accounting Clerk, Payroll, Business Affairs 206 Holladay; 103 Enterprise St.	2152	TE2-7652

D

*Dabbs, Olive S., Steno., Experimental Statistics 604 General Laboratory; 2131 Woodland Ave.	2534	833-3309
*Daggerhart, Diane J., Secretary, Agri. Econ. 201 Patterson; J-13 McKimmon Village	2604	832-2228
*Dahiya, Raghunath S., Res. Assoc., Food Science 128B Polk; 3100 Raymond St.	2795	834-0242
*Dahle, Robert D., Extn. Instructor, Extn. Economist, Agri. Econ. 18-C Patterson; 5031 New Castle Rd.	2664	834-6505
*Dalla Pozza, Ada B., District Home Economics Agent, Agri. Extn. 201-A Ricks; 535 East Cornwall Rd., Cary	2788	467-1921

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Dalton, Douglas R., Agri. Res. Asst., Animal Science 242 Polk; 4421 N. Blvd.	2763	
*Dalzell, Helen B., Steno., Engr. Research 127 Riddick; Box 383, Wake Forest	2346	556-5345
*Dameron, T. B., Jr., Adjunct Assoc. Prof., Poultry Science 600 Wade Ave.; 414 Scotland St.	834-2588	787-2846
*Dandridge, Edmund P., Jr., Assoc. Prof., English 112 Winston; 4316 Galax Dr.	2464	787-2703
*Daniel, Carl R., Nuclear Electronics Tech., Nuclear Reactor Project 32 Burlington Nuclear Labs.; Box 554, Cary	2321	467-1498
*Daniel, Harry T., Information Specialist, Agri. Econ., 205-B Patterson; 5207 Melbourne Rd.	2600	828-2067
Daniel, Justice G., Maintenance Instructor, Truck Driver Training, General Extension 113 1911 Building; 638 Wait Ave., Wake Forest	2268	556-3666
*Danieley, Audrey Y., Typist, Admissions & Registration 7 Peele; 2510 Stafford Ave.	2435	TE3-8983
*Daniels, Raymond B., Soil Scientist, USDA, Soil Science 307 Williams; 307 Griffis St., Cary	2636	467-1572
*Dauterman, Walter C., Assoc. Prof., Entomology 7 Withers; 4227 Arbutus Dr.	2754	787-1626
*Davenport, Donald G., Asst. Prof., Animal Science 242-B Polk; 336 North Field Dr.	2763	787-2681
*Davey, Charles B., Assoc. Prof., Soil Science 366 Williams; 3704 Avent Ferry Rd.	2649	834-0409
*Davis, Adam Clarke, Asst. Prof., Rural Soc. 334 1911 Building; 4213 Boxwood Rd.	2701	787-1751
*Davis, Elmo L., Inst., Truck Driver Training, General Extension 113 1911 Building; Rt. 7, Box 169, Raleigh	2263	828-2449
*Davis, Henry M., Adjunct Professor, Mineral Industries 108-A Page; 1309 Rosemary Ave., Durham	2377	286-2316
*Davis, Jack L., Instructor, General Extension 113 1911 Building; 2519 Clark Ave.	2263	828-5959
*Davis, Lewis J., Textile Res. Tech., Textiles 301 Nelson Textile; North Main St., Wake Forest	2578	EX5-3844
*Davis, M. P., Res. Assoc., Engr. Research 141 Riddick; 4908 Western Blvd.	2351	833-4541
*Davis, Philip H., Assoc. Prof., English 109 Winston; 814 Woodburn Rd.	2464	832-4827
Davis, Susanne T., Key Punch Oper., Animal Science Dairy Records Processing Center, Leazar; 1310 Wake Forest Rd.	2632	834-4154
*Davis, Walter H., Agri. Res. Superv., Crop Science 158 Williams; 2332 Millbank St.	2657	834-7551
*Davis, William R., Assoc. Prof., Physics 410E General Laboratory; 707 Graham St.	2513	TE3-5422
Dayton, Madeline I., Steno., Extn., Horticultural Science 227-235 Kilgore; 1004 Canterbury Rd.	2686, 2687	TE3-9871
*DeArmond, M. Keith, Asst. Prof., Chemistry 115 Withers; 3018 Medlin Dr.	2538	828-9776
*Deekins, A. Maynard, Publications Editor, Agri. Information 118 Ricks; 4125 Yadkin Dr.	2804	787-0568
*DeLapp, Carolyn G., Statistical Aide, Experimental Statistics 510 General Laboratory; 2534 Remington Rd.	2541	TE4-7634
*Della, Thomas W., Inst., Acting Asst. Dir., Computing Center 11-F Nelson Textile; 1225 Chaney Rd.	2510, 2518	TE4-7582
*Denmark, Florence V., Secretary, Rural Soc. 339 1911 Building; 2210 St. Mary's St.	2702	TE2-6765

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Derbyshire, Stephen W., Res. Assoc., Engr. Research 347 Riddick; 5208 Olive Rd.	2340	834-0436
*Derr, Paul H., Head, Physical Education Carmichael Gymnasium; 3117 Eton Rd.	2486	TE3-6455
*Detwiler, Lessie L., Secretary, Student Housing Rental Office Leazar; 1424 Duplin Rd.	2440	832-7172
*Dick, Betty, Assistant, Agricultural Mission to Peru 1-H Patterson; 4708 Wedgewood St.	2671, 2672	787-0727
*Dick, Vita M., Typist, Business Affairs B Holladay; 223 Gordon St., Cary	2144	467-5692
*Dickens, James W., Asst. Prof., USDA, Agri. Engr. 126 Agri. Engr.; 1508 Simpkins St.	2682	TE4-3729
*Dickson, Lt. Colonel Robert S., III, USA, Asst. Prof., Mil. Sci. 154 Coliseum; 1108 Manchester Dr.	2428, 2429	787-3106
*Dillard, Emmett U., Assoc. Prof., Animal Breeding, Animal Science 226 Polk; Route 1, Cary	2769	467-1571
*Dillard, Wayne A., Agri. Res. Asst., Genetics 228 1911 Building; Rt. 1, Raleigh	2661	787-1720
*Dills, Donna O., Secretary, Social Studies 145 Harrelson; 2506 Country Club Ct.	2479	TE4-7155
*Dixon, Daniel R., Asst. Prof., Economics 134 Harrelson; 1022 Shelley Rd.	2472	787-0033
*Dixon, Lyman B., District 4-H Club Agent, Agri. Extn. 208 Ricks; 1612 Franklin Rd.	2802, 2803	TE3-3281
*Dixon, Penny H., Accounting Clerk, Agri. & Life Sciences 120-H Patterson; Rt. 1, Benson	2714, 2715	
*Doak, George O., Professor, Chemistry 8 Withers; Old Mill Rd., Box 853, Chapel Hill	2549	942-4576
*Dobbins, Edith J., Agri. Res., Botany & Bacteriology 27 Gardner; 1305 Duplin Rd.	2728	832-3365
*Dobbins, Grover C., District Agri. Agent, Agri. Extn. Service 303 Ricks; 3428 Wade Ave.	2789	TE4-9026
*Dobrogosz, Walter J., Asst. Prof., Bacteriology, Botany & Bact. 25 Gardner; 4500 Revere Dr.	2728	787-0264
*Dobson, Sam H., Extn. Prof. in Crop Science, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
Dodd, Marcia J., Steno., Textiles 103B Nelson Textile; 2614 Churchill Rd.	2577, 2578	832-3662
*Doggett, J. F., Extn. Asst. Prof. in Soil Science, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Doggett, Wesley O., Asst. Dean, Phys. Sci. & Applied Math. 116 General Laboratory; 2452 Oxford Rd.	2502, 2503	828-4029
*Dolan, Robert J., State Leader, Training Extn. Education, Extn. Personnel Development 109 Ricks	2819	
*Donaldson, William E., Assoc. Prof., Poultry Nutrition, Poultry Sci. 213 Scott; 4401 Laurel Hill Rd.	2627	787-1690
*Doolittle, Jesse S., Professor, Mechanical Engr. 307 Broughton; 813 Graham St.	2371	833-8215
*Dorsey, William E., Agri. Res. Superv., Animal Science Animal Disease Lab.; 217 W. Durham Rd., Cary	2738, 2739	HO7-9877
†Dosher, Doris A. B., Superv., Drafting & Blueprinting, Agri. Engr. 208 Agri. Engr.; 2306 Fairview Rd.	2677	832-8827

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Dough, Robert L., Asst. Prof., Physics 216 General Laboratory; 808 Runnymeade Rd.	2509	TE2-4674
*Dougherty, Betty Ann, Res. Instructor, Textiles B49 Nelson Textile; 4426 Memorial Dr.	2558	787-2691
Douglas, James A., Farm Hand, Animal Breeding, Animal Science Finley Farm, Rt. 3; Finley Farm, Rt. 3	2759	
*Douglass, Ross S., Forest Mgt. Ext. Spe., Extension Forestry 268 Kilgore; Rt. 6, Raleigh	2891	787-3820
*Dow, Janet H., Instructor, English 117 Winston; 3300 Hampton Rd.	2464	787-4562
*Dow, Louis A., Assoc. Prof., Economics 131 Harrelson; 3300 Hampton Rd.	2472	787-4562
*Downs, Murray S., Asst. Prof., History & Political Science 109 Harrelson; 3017 Glenridge Dr.	2481	828-9830
*Drabick, Lawrence W., Assoc. Prof., Rural Soc. & Agri. Ed. 342 1911 Building & 123 Tompkins; 1217 Kimberley Dr.	2702, 2234	787-0582
*Drewes, Donald W., Asst. Prof., Psychology 226 Tompkins; 4209 Boxwood Dr.	2252	787-3319
*Driscoll, Ernie P., Asst. Football Coach, Athletics 115 Coliseum; 4905 Rampart St.	2101	787-0482
*Dudley, John W., Assoc. Prof., Crop Science 182-A Williams; 1501 Ashburton Rd.	2657	TE3-4031
*Duffield, John W., Professor, Forest Management 170 Kilgore; 215 Furches St.	2883	828-9534
Duke, Mary L., Nurse Superv., Student Health Service Clark Infirmary; 2021 Noble Rd.	2410	834-6529
*Duke, T. W., Adjunct Asst. Prof., USDI, Zoology Radiological Labs., Bureau Commercial Fisheries, Beaufort	Beaufort 728-4597	
*Dunlap, George H., Director of Placement & Professor, Textiles 120 Nelson Textile; 605 Lake Boone Tr.	2572	787-4592
*Dunn, McKeever R., Res. Asst., Poultry Science Sensory Physiology Lab., Poultry Research Farm, College Rd., 901 Hadley Rd.	2822	834-3534
*Dunston, Deport L., Mechanic, Research Shop, Agri. Engr. 130 Agri. Engr.; Method	2681	834-4243
*Dupree, Alma K., Typist, Registration 2 Peele; Rt. 2, Poole Rd.	2432	TE4-1340
*Durham, Ernest E., Director, Auxiliary Services, Bus. Affairs 207 Holladay; Rt. 1, Cary	2157	467-1316
*Dyer, Vivian P., Steno., Plant Pathology 10 Gardner; Box 518, Wendell	2711	365-7273
*Dyson, Peter J., Asst. Prof., Forestry 69 Kilgore; Rt. 8, Box 69, Raleigh	2887	TE3-4044

E

*Eargle, Fred L., Industrial Specialist, Industrial Extn. Service 2 IES Building; 2471 Milburnie Rd.	2356	833-8817
Easley, John B., Asst. Prof., English 117 Winston; 2815 Van Dyke St.	2464	828-6125
*Easter, William T., Instructor, Electrical Engr. 306 Daniels; Rt. 1, Lake Dr., Cary		467-9989
Eastman, Clyde F., Visiting Asst. Prof. in Soil Science, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Eaton, Peggy J., Steno., Botany & Bacteriology 146 Gardner; 2700 Cartier Dr.	2725	834-7235

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Eckels, Arthur R., Professor, Electrical Engr. 331 Daniels; 1417 Dellwood	2339	834-3756
Eckols, Patti A., Steno., Information Services 202 Holladay; 3109 Hillsboro St.	2874, 2875	832-7925
*Edgerton, Moretta D., Accounting Clerk, N. C. Crop Impr. 193 Williams; 3902 Vesta Dr.	2851, 2852	828-6986
*Edsall, Preston W., Professor & Head, History & Political Science 102 Harrelson; 205 Woodburn Rd.	2482	832-1698
*Edwards, Betty, Stock Clerk, Central Stores 108 Morris; 2716 Knowles St.	2197, 2198	828-5908
*Edwards, Billie Jean M., Agri. Res. Asst., Animal Breeding, Animal Sci. 10 Polk; 1617 Bickett Blvd.	2768	833-2103
*Edwards, Earle L., Head Football Coach, Athletics 115 Coliseum; 613 Dixie Tr.	2101, 832-6934	834-2657
*Edwards, Jennings B., Assoc. Prof., Physical Education Carmichael Gymnasium; 3200 Walnut Tr.	2487	828-8813
*Edwards, John A., Assoc. Prof., Engr. Mechanics 323 Riddick; 1213 Chaney Rd.	2342	832-3218
*Edwards, Howard E., Jr., Lithographic Pressman, Agri. Information 21 Ricks; Box 803, Wendell	2791	
Edwards, Tommie D., Agri. Res. Asst., Entomology 233 Gardner; 33½ Bagwell Ave.	2745	
Edwards, William F., Assoc. Prof., Social Studies 156 Harrelson; 2303 Churchill Rd.	2479	
*Ehrhardt, Suzanne S., Steno., Extn. Animal Husbandry 109 Polk; 5235 Vann St.	2762	832-0980
*Eichenberger, Fred, Asst. Prof., Product Design 203 Brooks; 219 Hawthorne Rd.	2205	832-2964
*Eisen, Eugene J., Asst. Prof., Animal Breeding, Animal Science 226 Polk; 1519 Brooks Ave.	2769	833-9596
*Eisen, Jacqueline S., Instructor, English 217-19 Winston; 1519 Brooks Ave.	2463	833-9596
*Eisenberg, Donna J., Steno., Zoology 155 Gardner; M-13, McKimmon Village	2741	834-5898
Elayadi, Nasser M., Res. Asst., Horticultural Science 222 Kilgore; 833, Apt. D, Daniels St.	2660	832-6800
*Eldridge, Herbert G., Assoc. Prof., English 11 Winston; 2333 Airline Dr.	2461	787-4559
El-Kammash, Magdi M., Asst. Prof., Economics 128 Harrelson; Rt. 2, Farrington Rd., Chapel Hill	2472	544-1658
Elkan, Gerald H., Assoc. Prof., Bacteriology 214 Gardner; 5109 Old Stage Rd.	2728	833-4953
*Elledge, Clifford, Agri. Res. Superv., Crop Science 112 Williams; Rt. 4, Raleigh	2638	834-2824
*Elleman, Thomas S., Assoc. Prof., Nuclear Engr. 143E Riddick; 704 Davidson St.	2301	787-2529
Ellen, Melba E., Library Asst., Circulation Library; 712 Glenwood Ave.	2845	TE3-8542
*Elliott, Robert N., Assoc. Prof., Social Studies 150 Harrelson; 2228 Rumson Rd.	2479	TE4-8551
Ellis, Brenda L., Key Punch Oper., Business Affairs 2 Holladay; 501 N. Blount St.	2140	834-9136
*Ellis, Don E., Professor & Head, Plant Pathology 114 Gardner; 324 Shepherd St.	2737, 2735	832-2239
*Ellis, Howard M., Extn. Prof., Agri. Engr. 200 Agri. Engr.; 1203 Walnut Tr.	2675	832-5887

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
Ellis, Ronald G., Jr., Typist Clerk, Agri. Information 15 Ricks; 21 Daisy St.	2791	832-3008
*Ellwood, Eric L., Professor & Head, Wood Sci. & Tech. 166 Kilgore; 4505 Pitt St.	2884	787-2895
*El-Saden, Munir R., Assoc. Prof., Mechanical Engr. 323 Broughton; 1002 Tower St.	2369	828-6995
*Ely, John F., Asst. Prof., Engr. Mechanics & Civil Engr. 319 Riddick, 422 Mann; 1014 Canterbury Rd.	2341, 2333	828-5334
*Emery, Donald A., Assoc. Prof., Crop Science 106 Williams; 5100 Avent Ferry Rd.	2640	VA8-3786
*Emory, Frances M., Secretary, Graduate School 104 Peele; 1208 Duplin Rd.	2871	833-6105
†Emory, Marcella B., Steno., Extn. Personnel Development 109 Ricks; 2610 Mayview Rd.	2818	828-3146
*England, Charles B., Res. Instructor, Soil Science 188 Williams; 49 Dixie Dr.	2657	833-5648
*England, Samuel, J. M., Asst. Statistician, Experimental Statistics 518-A General Laboratory; 4701 Western Blvd.	2541	833-8981
*Eriksen, Captain Norman G., USA, Asst. Prof., Military Science 154 Coliseum; 1220 Chaney Rd.	2428, 2429	833-7862
*Eskridge, Frances B., Secretary, Agri. Econ. 18 Patterson; 3401½ Clark Ave.	2611	828-2855
*Estes, Amos A., Agri. Res. Asst., Animal Science Fincrest Farm; Lake Wheeler Rd.	2759	828-3523
Estes, Edith S., Steno., Food Science 126 Polk; 2611 Cartier Dr.	2797	VA8-4024
*Etchells, John L., Professor, USDA, Food Science 225 Polk Hall; 122 Faircloth St.	2868	TE2-2270
*Etheredge, Robert W., Jr., Adjunct Assoc. Prof. in Architecture, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Evans, James B., Prof. of Bacteriology & Chairman, Microbiology Faculty, Botany & Bacteriology 213 Gardner; 1413 Dellwood Dr.	2728	833-0238
*Exum, Modine M., Asst. to Librarian, School of Design 201 Brooks; 2109 St. Mary's St.	2207	TE2-8412

F

*Fadum, Ralph E., Dean, Engineering 229 Riddick; 3056 Granville Dr.	2311, 2312	787-0071
*Fagan, Harry, Jr., Asst. University Physician, Student Health Ser. Clark Infirmary; 2508 Oxford Rd.	2410	834-8789
*Fails, Emol A., Professor, Economics 117 Harrelson; 1004 Schaub Dr.	2472	TE3-2935
*Fair, Anne Marie W., Secretary, Placement Office, Agri. & Life Sci. 112 Patterson; 627-C Daniels St.	2668	833-0482
Fairbanks, David I., Instructor, Electrical Engr. 208 Daniels; 809 Edmunds St.		828-3186
*Faircloth, Judith B., Res. Asst., Forestry 59 Kilgore; 701 Colonial Dr.	2887	834-0607
*Fairfax, Jane O., Secretary, Agri. Engr. 110 Agri. Engr., 2815 Friar Tuck Rd.	2696	833-9941
*Faison, Arlene E., Key Punch Operator, N.R.R.C. 505 Oberlin Road, Room 100; Rt. 1, Knightdale	2866	CO6-2348

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Faison, John R., Extension (County) Agent, Agri. Mission to Peru 1 Patterson, N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Faison, Odell J., Textile Res. Tech., Textiles 140 Nelson Textile; 314 O'Hara Dr., Clayton	2566	WA2-7275
*Falter, John M., Extn. Asst. Prof., Entomology 139 Gardner; 3608 Blueberry Dr.	2703	787-3283
*Farias, Amalia, Instructor, Modern Languages 309 Harrelson	2475	
*Farlowe, Joanne T., Steno., Animal Science 319 Polk; 807½ Harvey St.	2773	832-1975
*Farmer, Cheryl K., Typist, Acquisitions 112 Library; Rt. 1, Cary	2841	467-1478
Farmer, Fred S., Agri. Res. Asst., Entomology 236 Gardner; Rt. 8, Box 101, Raleigh	2745	828-3735
Farmer, George L., Programmer, N.R.R.C. 505 Oberlin Road, Room 100; 508 West Garner Loop Rd.	2866	832-4058
*Farmer, Kay K., Steno., Experimental Statistics 612 General Laboratory; 2306 McMullan Cr.	2531, 2532	834-7931
*Farrar, Baxter L., Agri. Res. Asst., Animal Science 10 Polk; Glascock St. Extension	2768	834-1678
*Farrell, Clyde, Res. Asst., Horticultural Science Horticultural Greenhouses; Box 521, Apex	2685	
Farrell, John C., Instructor, History & Political Science 104 Harrelson; 307 Chamberlain St.	2481	833-8761
Farrell, Richard H., Box Office Mgr., Coliseum 101 Coliseum; 2446 Wade Ave.	2106	832-0096
*Farrier, Maurice H., Assoc. Prof., Entomology 328 Gardner; 4025 Arbutus Dr.	2748	787-1933
*Ferguson, Clarence M., Visiting Prof., Extn. Personnel Dev. 109 Ricks; Wedgewood Apts.	2819	834-8708
*Ferguson, Grace S., Secretary, Animal Science 105 Polk; 4224 James Rd.	2771	828-2834
*Ferguson, John C., Extn. Assoc. Prof., Agri. Engr. 214 Agri. Engr.; 1213 Dixie Tr.	2676	834-7564
*Ferguson, Rachel H., Specialist, Nutritions, Agri. Extn. 213 Ricks; 2710 Vanderbilt Ave.	2786	834-9447
Ferrell, Janet G., Secretary, Agri. & Life Sciences 111 Patterson; 1505 Chester Rd.	2614	832-9501
*Ferrell, James K., Professor, Chemical Engr. 315 Riddick; 4205 Rowan St.	2327	787-3390
Fiedler, Maria-Luise, Res. Asst., Engr. Research 139 Riddick; 1931 Clark Ave.	2351	833-3435
*Fields, Hugh M., Extn. Asst. Prof., Wildlife Specialist, Zoology 168 Gardner; Rt. 1, Cary	2741	467-9978
*Fike, William T., Asst. Prof., Crop Science 488-B Williams; 1112 Gunnison Place	2652	787-1564
*Filton, Elga V., Res. Tech., Forest Genetics 70 Kilgore; 1313 Wake Forest Rd.	2884	833-9777
*Finch, Clara S., Statistical Clerk, Agri. Econ. 209 Patterson; 3709 Bland Rd.	2724	834-2602
*Finch, John B., Instructor, Industrial Arts 109 Tompkins; 907½ Mordecai St.	2237	828-3126
*Finkner, Alva L., Adjunct Professor, Experimental Statistics Research Triangle Institute, P. O. Box 490, Durham; 3909 Arrow Dr.	834-6246	787-4581

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* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Fish, Almon S., Jr., Asst. Prof., Horticultural Science 230 Kilgore; 1217 Chaney Rd.	2669	833-1014
*Fisher, C. Page, Assoc. Prof., Civil Engr. 217 Mann; 232 East Park Dr.	2332	832-3084
*Fisher, Hilbert A., Prof. Emeritus, Mathematics Gibsonville, N. C.		
*Fitchett, Mary C., Steno., Crop Science 409 Williams; 932 N. Boylan Ave.	2635	828-4020
*Fite, Robert E., Superv., Contract Construction, Physical Plant 202 Morris; 2638 Oberlin Rd.	2181	828-2783
*Fitts, James W., Director, International Soil Testing Project, & Professor, Soil Science 101 Williams; 1021 Gardner St.	2630	834-5701
*Fitzgerald, W. Curtis, Jr., Asst. Prof., Philosophy & Religion 349 Harrelson; 623 Stacy St.	2477	834-4057
*Flagg, Frank J., Asst. Gym. & Equip. Superv., Physical Education Carmichael Gymnasium; 2204 Roberts St.	2487	TE4-0901
*Fleming, Henry P., Asst. Prof., USDA, Food Science 310A Polk; 2840 Claremont Rd.	2868	838-9410
*Fleming, Wilton L., Asst. Director, Student Housing Housing Rental Office, Leazar; 3358 Alamance Dr.	2440	787-0618
*Floyd, Christine I., Key Punch Oper., N.R.R.C. 505 Oberlin Road, Room 100; 801 Friar Tuck Rd.	2866	828-6158
*Floyd, Gene G., Textile Res. Tech., Textiles 15 David Clark Labs.; 3014 Lewis Farm Rd.	2555	TE3-0897
*Flynn, Ligon B., Instructor, Architecture 213 Brooks; Laurel Hills Rd.	2203	787-2005
*Foil, J. Ed., State Agent, County Operations, Agri. Extn. 110 Ricks; 4108 Windsor Pl.	2813	787-0716
*Fordyce, Hugh R., Asst. Director for Admissions, Admissions & Registration 112 Peele; 3458 Leonard St.	2431, 2437	828-6725
*Fore, Julian M., Professor, Agri. Engr. 108 Agri. Engr.; 1310 Rand Dr.	2696	833-7650
*Forrest, Linda P., Secretary, Agri. Econ. 210 Patterson; Lake Wheeler Mobile Estates	2600	832-1048
*Foster, Charles I., Professor, Social Studies 149 Harrelson; 1308 Gorman St.	2479	TE4-2450
*Fountain, Alvin M., Professor, English 121 Winston; 2620 Mayview Rd.	2464	833-1055
*Fouraker, R. S., Prof. Emeritus, Electrical Engr. 601 Brooks Ave.		832-3094
*Foushee, Frances B., Secretary, History & Political Science 110 Harrelson; 227 Lynwood Ln.	2481	787-2241
*Fowler, Yvonne H., Steno., Alumni Affairs 105 Alumni; Rt. 6, Charles Dr.	2869, 2860	787-0793
Fraker, Anna C., Res. Assoc., Engr. Research 139 Riddick; 122 Hillcrest Rd.	2351	834-7173
*Franks, Paul, Agri. Res. Asst., Animal Science College Dairy Farm, 4700 Hillsboro St.; Route 4, Raleigh	2674	828-4581
*Freedman, Leon D., Assoc. Prof., Chemistry 9 Withers Hall; 3407 Leonard St.	2549	828-8178
Freeman, Doris H., Secretary, Economics 122 Harrelson; 1503 Jarvis St.	2472	TE2-1438
*Freeman, Virginia W., Personnel Asst., Personnel Primrose; 604 Harp St.	2135	TE3-2239
*Frelund, Marsha D., Agri. Res. Asst., Genetics 218-E Clark Labs.; 1031 Nichols Dr.	2629	834-3128

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Fromm, Daniel, Assoc. Prof., Food Science 8 Scott; 2609 Avent Ferry Rd.	2628	TE4-0608
*Fulcher, Reubin R., Agri. Res. Asst., Crop Science 429 Williams; Rt. 1, Raleigh	2642	787-4896
*Fulghum, James S., Housing Rental Officer, Student Housing Housing Rental Office, Leazar Hall; 3311 Onslow Rd.	2440	TE2-2729
*Fuller, Alice M., Asst. Librarian, Textiles 111 Nelson Textile; 4101 White Pine Dr.	2562	787-0150
*Fulp, Judy K., Steno., Food Science 128 Polk; C-17 McKimmon Village	2777	833-5023
*Funderburk, William F., Campus Engineer, Physical Plant 200 Morris; 417 Cornwall Rd., Cary	2181	467-1857
*Fuquay, Janet B., Data Processor, Animal Science Dairy Records Processing Center, Leazar; 2124 Ridge Rd.	2632	787-4188

G

*Galbraith, Alan S., Adjunct Prof., Mathematics 226 Harrelson; 1025 Dacien Ave., Durham	2385	682-8702
*Galler, William S., Asst. Prof., Civil Engr. 414 Mann; 2013 Lewis Cir.	2333	828-6197
*Galletta, Gene J., Assoc. Prof., Horticultural Science 232 Kilgore; 1409 Ashburton Rd.	2669	VA8-5330
*Ganzer, Katherine P., Res. Analyst, Dean of Faculty A Holladay; 707 West Morgan St.	2192, 2193	828-5133
*Garb, Gerald, Assoc. Prof., Economics 126 Harrelson; 1212 Dogwood Ln.	2472	TE3-6574
*Garcia, Bert H., Assoc. Prof., Mechanical Engr. 221 Broughton; 807 Beaver Dam Rd.	2369	832-7668
*Gardner, Lawton B., Agri. Res. Asst., Crop Science Agronomy Greenhouse; 906 Marlborough Rd.	2640	TE4-6888
*Gardner, Monroe E., Professor, Horticultural Science 122 Kilgore; 2708 Bedford Ave.	2683	TE2-4178
*Gardner, Sue M., Machine Room Superv., N.R.R.C. 505 Oberlin Road, Room 100; 906 Marlborough Rd.	2866	834-6888
*Gardner, Susan L., Statistical Clerk, Agri. Econ. 7 Patterson; 2315 Van Dyke Ave.	2612	833-3254
*Garmon, William M., District 4-H Club Agent, Agri. Extn. 208 Ricks; 910 Ralph Dr., Cary	2802, 2803	467-9902
*Garner, Louise L., Agri. Res. Asst., Plant Pathology 31 Gardner; 1405 Hathaway Rd.	2736	833-1870
*Garren, Henry W., Professor & Head, Poultry Science 120 Scott; 308 Bashford Rd.	2626	834-7275
*Garren, Martha J., Instructor, Mathematics 326 Harrelson; 308 Bashford Rd.	2386	TE4-7275
*Garriss, Howard R., Extn. Prof., In Charge, Plant Pathology 9 Gardner; 3220 Bedford Ave.	2711	TE2-2091
*Garrison, Walter S., Textile Res. Tech., Textiles 140 Nelson Textile; 2925 Haven Rd.	2566	TE3-5718
*Gates, Louis E., Chemical Engineer, Industrial Extn. Service B-2 IES Building; Apt. 9B Carolina Hotel	2358	832-8811
*Gayler, Joachim, Visiting Assoc. Prof., Textiles B-2A Nelson Textile; 2603 Broadwell Dr.	2569	828-5570
†Geile, Dorothy T., Library Asst., Textiles 111 Nelson Textile; 2509 Glenwood Ave.	2562	TE2-7486
*Geile, Robert T., Asst. Personnel Officer, Personnel Services Primrose; 4705 Glen Forest Dr.	2135	787-0917

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Gentry, Rachel L., Accounting Clerk, Animal Science 123-A Polk; 410½ Chamberlain St.	2755	828-3145
George, Edwin D., Agri. Res. Asst. Animal Breeding, Animal Sci. Finley Farm; Rt. 3, Box 667-A	2759	
*Geraghty, Ruby T., Steno., Animal Science 232-D Polk; 1003 James Pl.	2763	834-1608
*George, James D., Extn. Prof., Animal Science 104 Polk; Florida State University, Tallahassee, Fla.	2771	
*George, Katherine G., Agri. Res. Asst., Animal Science 209 Polk; 681 Wimbleton Dr.	2763	832-6033
*George, Pulivelil M., Instructor, Soc. & Anthro. 361 Harrelson; 110 Daniels Rd., Chapel Hill	2491	967-3036
*Gerstel, Dan U., William Neal Reynolds Professor, Crop Science 486 Williams; 1410 Duplin Rd.	2644	834-2155
*Getzen, Forrest W., Assoc. Prof., Chemistry 19 Withers; 2802 Gloucester Rd.	2538	834-5211
Gibbs, Eleanor, Agri. Res. Tech., Food Science Basement Kilgore; B-2 Country Club Homes	2691, 2692	TE4-4768
Gilbert, John H., Instructor, History & Political Science 116 Harrelson; Apt. G-4, Raleigh Apts.	2481	833-5587
*Gilbert, William B., Assoc. Prof., Crop Science 154 Williams; 904 Brookwood Dr.	2657	TE4-0191
*Gilmore, Robert C., Supt. & Instructor, Wood Sci. & Tech. Hodges Lab.; 5031 Kaplan Dr.	2881	TE2-9587
*Gilreath, William F., Agri. Res. Asst., Crop Science 488 Williams; Rt. 1, Box 320A, Raleigh	2652	787-2481
*Glarum, Emil, Freight Accountant, Freight 108 Morris, Rt. 8, Raleigh	2197, 2198	787-4361
Glasgow, Judy G., Steno., Electrical Engr. 320 Daniels; 204½ East Park Dr.	2339	832-7182
*Glazener, Edward W., Director of Instruction, Agri. & Life Sciences 111 Patterson; 3424 Lewis Farm Rd.	2614	787-4478
*Glenn, Karl B., Assoc. Prof. Emeritus, Electrical Engr. 309 N. Bloodworth		TE2-1207
*Glenn, William A., Adjunct Assoc. Prof., Experimental Statistics & Industrial Engineering Research Triangle Institute, P. O. Box 490, Durham; 906 King St., Cary	2529, 2363	467-1345
*Gleit, Chester E., Assoc. Prof., Chemistry 314 Withers; 132 North King Charles Rd.	2538	
*Glover, Fanny Ruth, Secretary, Agri. Econ. 10 Patterson; 904 Weston St.	2603	833-7006
*Glover, Keith V., Steno.-Clerk, Agri. Information 116 Ricks; 1616 Seminole Tr.	2804	833-9525
*Glover, John W., Extn. Asst. Prof., Agri. Engr. 213 Agri. Engr.; 3008 Churchill Rd.	2676	834-0516
*Glowczewski, Jerzy E., Assoc. Prof., Architecture 317 Brooks; 2106 St. James Rd.	2203	833-1267
Godwin, Faye M., Steno., Zoology 218-J David Clark Labs.; 1082 Nichols Dr.	2631	834-8790
*Goetze, Alfred J., Assoc. Prof., Electrical Engr. 110 Daniels; 615 Stacy St.	2335	832-5861
*Godfrey, Marvin R., Res. Instructor, N. C. Crop Improvement 189 Williams; 837 Jones Ave.	2851	TE2-3340
*Gold, Harvey J., Post-doctoral Fellow, Experimental Statistics 518-A General Laboratory; 2128 Buckingham Rd.	2541	833-6821

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Goldman, Jay, Professor, Industrial Engr. 336 Riddick; 415 Stacy St.	2362	
*Goldsmith, Richard W., Asst. Prof., English 223 Winston; 1926 Highland Pl.	2463	787-4242
*Goldston, Eugene F., Asst. Prof., Soil Science 105 Williams; 5301 W. Lakeside Dr.	2643	832-1613
Good, Ruth, Editorial Asst., Agri. Econ. 202 Patterson; 1055 Nichols Dr.	2606	834-8337
*Goode, F. M., Instructor, Agri. Econ. 206 1911 Building; 307 Shephard St.	2617	834-3381
*Goode, Lemuel, Assoc. Prof., Animal Science 218 Polk; 3336 Thomas Rd.	2763	787-4561
*Gooding, Guy V., Jr., Adjunct Asst. Prof., USDA, Plant Pathology Forestry Services, Research Triangle, Durham; 2514 Clark Ave.	Durham 549-8193	828-6420
Goodson, Dotty, Secretary, Soil Science 101 Williams; 611 West Lane—Apt. 1	2630	834-7507
*Gordon, John B., Administrative Officer, Business Affairs 208 Holladay; 1065 Nichols Dr.	2157	832-1946
*Gossett, D. M., Extn. Asst. Prof., Crop Science 410 Daisey Ave., Waynesville	Waynesville 456-3943	456-3654
*Gouge, Margaret G., Scientific Aide, Plant Pathology Extn. 10 Gardner; 5309 W. Lakeside Dr.	2711	834-5697
*Gouge, Wiley L., Jr., Concessions Mgr., Athletics & Students Supply 119 Coliseum; 5309 W. Lakeside Dr.	2123, 2106, 834-9197	834-5697
*Gower, Joseph R., Manager, Laundry Laundry; 410 Lombard St., Clayton	2122	WA2-7291
*Grady, Perry L., Research Asst., Textiles B-5C Nelson Textile; 1210 Chaney Rd.	2569	VA8-3204
*Grandage, Arnold H. E., Professor, Experimental Statistics 614-F General Laboratory; 3030 Churchill Rd.	2531, 2532	TE2-6527
*Grandage, Dorothy, Technician, Zoology 355 Gardner; 3030 Churchill Rd.	2741	832-6527
*Grant, Catherine L., Computer Programmer, Animal Science Dairy Records Processing Center—Leazar; 12-B Dixie Dr.	2632	
*Grant, Chester, Asst. Trainer, Athletics Coliseum; 2209 Everett Ave.	2111	832-8783
*Grauer, Norma J. B., Administrative Sec., Engr. Research 127 Riddick; 633 Ashford St.	2345, 2346	828-8819
Gray, Mary E., Accounting Clerk, Agri. Econ. 214 Patterson; 2104-D Smallwood Ave.	2610	834-4902
*Gray, Tommy N., Agri. Aide, USDA, Agri. Engr. Agri. Engr. Lab.; 3025 Lewis Farm Rd.	2663	828-8868
*Green, Dorothy F., Steno., Experimental Statistics 103-A General Laboratory; Rt. 7, Raleigh	2529	828-2448
Green, Sue D., Secretary, Agri. Extn. 105 Ricks; Glenwood Gardens, Apt. E	2706	787-3736
Green, Sylvia M., Secretary, Agri. Econ. 201 Patterson; 727 West Morgan St.	2606	828-5156
*Greene, Ralph B., In Charge, Research Shop, Agri. Engr. 130 Agri. Engr.; 2106 Ridge Rd.	2681	834-2753
Greene, Rebecca A., Steno., Mathematics 324 Harrelson; 1608 N. Blount St., Apt. D	2386	TE4-2485
*Greenlaw, Ralph W., Assoc. Prof., History & Political Science 108 Harrelson; 5033 Yadkin St.	2481	787-2078

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Greenwood, Sandra H., Agri. Res. Tech., Animal Science 329 Polk; I-26 McKimmon Village	2773	833-1486
*Gregory, John H., Instructor, Animal Science 219 Polk; 3217 Ward Rd.	2763	834-0832
*Gregory, M. P., Assoc. Geneticist, Genetics 102 Williams; 3808 Blue Ridge Rd.	2640	787-4836
*Gregory, Max E., Extn. Asst. Prof., Food Science 204A Polk; 4133 White Pine Dr.	2779	787-2101
*Gregory, Walton C., Professor, Crop Science 102 Williams; 3808 Blue Ridge Rd.	2640	787-4836
Gregory, Wilton W., Instructor, General Extension 113 1911 Building; 5311 Western Blvd.	2263	834-0076
*Greyer, Charles P., Asst. Dir. for Records, Adm. & Registration 12-E Peele; 3116 Glenwood Ave.	2434	787-2560
*Gribble, Elizabeth B., Steno., Student Health Service Clark Infirmary; 3323 Coleridge Dr.	2410	832-1205
*Grice, Mary J., Agri. Res. Tech., Animal Science Animal Disease Lab.; Rt. 8, Arrington Rd.	2738, 2739	834-1009
Griffin, Hazel C., Special Lecturer, English 17 Winston; J-1 Grosvenor Garden Apts.	2461	834-5314
Griffin, Sara L., Agri. Res. Tech., Crop Science 405 Williams; 2802 Donavon Place	2635	833-2000
*Griffin, Wade E., Instrument Shop Superv., Engr. Research 10 Riddick; Duraleigh Rd., Box 195, Rt. 8	2348	787-3044
*Griffin, Motte V., Jr., Public Information Officer, General Extension 116 1911 Building; 3132 Brentwood Rd.	2261, 2262	TE4-8841
†Grinnells, Claude D., Prof. Emeritus, Animal Science Monticello, Florida		
*Griset, Iona T., Secretary, Phys. Sciences & Applied Math. 113 General Laboratory; 1623 Dixie Tr.	2501, 2502	834-1439
*Grissom, Felix E., Agri. Res. Asst., Animal Science 243 Polk; 320 S. Bloodworth St.	2773	832-4851
*Groff, John C., Instrument Maker, Textiles B-35 Nelson Textile; 410 S. Boylan Ave.	2559	834-9573
*Groff, Margaret V., Accounting Clerk, Animal Science Dairy Records Processing Center, Leazar; 711 Grove Ave.	2632	834-0820
*Grosch, Daniel S., Professor, Genetics 349 Gardner; 1222 Duplin Rd.	2732	833-5430
*Gross, H. Douglas, Assoc. Prof., Crop Science 186-A Williams; 5301 E. Lakeside Dr.	2657	833-0584
*Grover, Elliot G., Head, Textile Tech. & Professor, Textiles 103C Nelson Textile; 804 Lake Boone Tr.	2577	787-4624
*Guerra, Olga R., Clerk, Print Shop Print Shop; 2716 Dorchester Ct.	2132	
*Guion, Thomas H., Assoc. Prof., Textile Chemistry 209 David Clark Labs.; 400 N. Glen Dr.	2555	787-0459
*Gullette, Florence M., Secretary, General Extension 138 1911 Building; 2714 Everett Ave.	2264	833-2900
*Gullette, George A., Professor & Head, Social Studies 144 Harrelson; 2714 Everett Ave.	2479	TE3-2900
*Gulley, Jeannine, Secretary, Wolfpack Club 108 Coliseum; 200 Robin Hood Dr.	2112	834-9920
*Gunter, Marguerite H., Secretary, Agri. Econ. 210 Patterson; 4111 Laurel Ridge Dr.	2602	787-1430
Gupta, Bhupender S., Visiting Asst. Prof., Textiles S-50 Nelson Textile; 926 N. Boylan Ave.	2550	TE2-0452

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
†Gurkin, Sylvia G., Secretary, English 118 Winston; 3021 Medlin Dr.	2464	787-5914
*Gurley, Edward D., Asst. Prof., Engr. Mechanics 321 Riddick; 5405 Center St.	2342	832-0238
*Guthrie, Frank E., Asst. Dean for Research, Graduate School, & Professor, Entomology 104 Peele, 228 Gardner; 600 Beaver Dam Rd.	2872, 2745	834-7267
*Gwynn, G. R., Asst. Prof., USDA-ARS, Crop Science 164 Pine Cone Dr., Oxford		3816

H

*Haasis, Frank A., Professor, Plant Pathology 8 Gardner; 3218 Onslow Rd.	2721	TE4-3005
*Hackler, W. C., Professor, Ceramic Engr., Mineral Industries 108-A Page; 1002 Canterbury Rd.	2377	TE3-2186
*Haddock, Shelba H., Typist, Personnel Primrose; Rt. 1, Holly Springs	2135	MH7-4540
*Hader, Robert J., Professor, Experimental Statistics 614-B General Laboratory; 313 Oakview Dr.	2531, 2532	834-3101
*Haig, Fred M., Prof. Emeritus, Animal Science Creedmore Road		787-1127
*Hairr, Betty L., Textile Lab. Tech., Textiles B-45 Nelson Textile; 1811 Ridley St.	2558	828-7124
*Hall, George L., Director, ETV Educational Television Studio, 3117 Western Blvd.; 3106 Leonard St.	2853	TE3-7125
*Hall, Geraldine A., Secretary, Agri. Extn. Service 104 Ricks; 4829 Rembert Dr.	2812	787-0840
Hall, John L., Asst. Prof., Crop Science 402 Williams; 415 Morrison Ave.	2635	832-6401
*Hall, Patricia W., Key Punch Oper., N.R.R.C. 505 Oberlin Road, Room 100; 1420 Eden Lane	2866	828-9674
*Hall, Robert A., Sergeant, USAF, Aerospace Studies 145 Coliseum; 917 Carlisle St.	2427	834-5043
†Hall, Ruth B., Asst. Prof., Modern Languages 305 Harrelson; 1812 Craig St.	2475	TE2-5026
*Hall, Shirley W., Steno., General Extension 134 1911 Building; 3311 Baugh St.	2266	828-9722
*Halperen, Max, Asst. Prof., English 19 Winston; 2706 Ashland Ave.	2461	834-6383
*Haltiwanger, William L., Extn. Agronomy Specialist, Crop Science 126 Williams; 1435 Duplin Rd.	2639	832-6081
*Hamby, Dame S., Professor, Textiles 102 Nelson Textile; 319 Golf Course Dr.	2577, 2578	TE2-2619
*Hamilton, C. Horace, William Neal Reynolds Professor, Rural Soc. 338 1911 Building; 1515 Duplin Rd.	2702	TE3-7477
*Hamilton, Henry R., Programmer, Computing Center 11-D Nelson Textile; 104½ Montgomery St.	2510, 2518	828-6073
*Hamilton, Hubert E., Dairy Plant Operator, Food Science Basement Polk; 500 Poplar Dr.	2700	TE4-4415
*Hamme, John V., Assoc. Prof., Engr. Research & Mineral Industries 1 Riddick Annex; 2904 Claremont Rd.	2347	834-8556
*Hammond, Leigh H., Extn. Assoc. Prof., Extn. Economist, Agri. Econ. 209-D Patterson; 4516 Laurel Hill Rd.	2618	787-2601

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Hampikian, Aram K., Adjunct Prof., Electrical Engr. 1105 Manchester Dr.		787-0435
*Hampton, Leonard A., Forest Management Extn. Specialist, Forestry Extension 55 Kilgore; 1001 Aversboro Rd., Garner	2891	EM2-1845
Hancock, Joseph S., Assoc. Director, Information Services 202 Holladay; 2811½ O'Berry St.	2874, 2875	TE3-4796
*Hanes, R. E., Instructor, Soil Science Box 90, Manteo		
*Hannah, Harold E., Agri. Res. Asst., Crop Science 102 Williams; 506 Lansing St.	2640	TE3-2685
Hansen, Donald J., Asst. Prof., Mathematics 230 Harrelson; 913 St. Mary's St.	2384	
*Hanson, Durwin M., Professor & Head, Industrial Education 111-B Tompkins; 4513 Pamlico Dr.	2241	787-0970
*Hanson, Karl P., Director, Freshman Engineering Division 241 Riddick; 804 Rosemont Ave.	2319	833-2253
*Hanson, Warren D., Professor, Genetics 343-I Gardner; 1201 Westmoreland St.	2704	787-4116
*Hardee, Kathryn B., Secretary, English 112 Winston; Apt. V, Glenwood Gardens	2464	787-1055
Harden, Katharine P., Secretary, Registration 7 Peele; 1615 Hillsboro St.	2435	TE2-7502
*Harder, John J., Asst. Prof., Industrial Engr. 334 Riddick; 1204 Gunnison Pl.	2362	787-3895
*Hardin, James W., Assoc. Prof., Botany & Forestry & Curator of the Herbarium, Botany & Bacteriology 249 Gardner; 200 Furches St.	2726	834-1598
*Hardison, Jane F., Sec.-Treas., N. C. Foundation Seed Producers, Inc. 124 Williams; 2705 Bromley St.	2821	832-9988
*Hardwicke, Callie C., District Home Economics Agent, Agri. Extn. 205 Ricks; 1214 Cowper Dr.	2708	834-3805
Hargrave, Harry A., Instructor, English 215 Winston; 643 Wimbleton Dr.	2463	787-2018
*Harkema, Reinard, Professor, Zoology 363 Gardner; 1430 Chester Rd.	2741	832-1857
*Harmon, Kennett R., Extension (County) Agent, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
Harmon, Sue J., Agri. Res. Tech., Food Science Basement Kilgore; 1051 Nichols Dr.	2691, 2692	VA8-8504
*Harmon, Sadie J., Asst. Prof., English 217-19 Winston; 2322 Byrd St.	2463	833-1337
*Harper, Kathryn S., Agri. Res. Tech., Food Science 138 Polk; Mendenhall Mobile Estates, Rt. 1, Cary	2795	832-5384
*Harper, John A., Agri. Res. Asst., Plant Pathology 209 Gardner; 516 Fisher St., Clayton	2751	922-7066
*Harper, Lucille E., Secretary, Nuclear Engr. 4 Burlington Nuclear Labs., 129 Hudson St.	2302	832-6721
*Harper, Miriam G., Typist, Crop Science, N. C. Crop Improvement 189 Williams; 2601 Holloway Rd.	2851	TE2-4934
Harrell, Cleon, Assoc. Prof., Economics 140 Harrelson; 1226 Duplin Rd.	2472	828-2120
Harrell, Sherlyn E., Secretary, Agri. Admin. 104 Patterson; 3903 Avent Ferry Rd.	2718	828-5224

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Harrelson, Ida K., Accounting Clerk, Print Shop Print Shop	2132	828-7965
*Harrill, L. R., State 4-H Leader Emeritus 214 Library; 1607 Iredell Dr.		832-7628
*Harrington, Walter J., Professor, Mathematics 235 Harrelson; 3010 Ruffin St.	2384	833-1065
*Harris, Allen N., Shop Superv., Electrical Engr. 111 Daniels; 2612 Garner Rd.	2335	832-2328
*Harris, Curtis G., Stock Clerk, Chemistry 26 Withers; 2317 Bernard St.	2547	828-3933
*Harris, Elaine T., Administrative Secretary, Engineering 229 Riddick; 2836 Oberlin Rd.	2312	TE3-5022
*Harris, Harwell H., Professor, Architecture 312 Brooks; 20 Maiden Ln.	2203	828-9443
*Harris, James R., Extn. Prof., Veterinarian, Poultry Science 223 Scott; 3806 Lassiter Mill Rd.	2621	787-3494
*Harris, John H., Extn. Prof. in Charge Hort. Extn., Horticultural Science 235 Kilgore; 3214 Birnamwood Rd.	2686, 2687	TE2-9507
Harris, Mary E., District Home Economics Agent, Agri. Extn. 201-A Ricks; 2101-C Van Dyke Ave.	2788	834-5455
Harris, R. Anne, Secretary, Extn., Agri. Engr. 203 Agri. Engr.; 1211 Highland Rd., Garner	2675, 2676, 2677, 2678	362-9186
*Harris, Rachel P., Steno., Animal Breeding, Animal Science 226 Polk; 1211 Highland Rd., Garner	2769	EM2-9186
*Harrison, Carolyn G., Secretary, Business Affairs Holladay; I-5 Grosvenor Gardens	2157	833-5895
*Harrison, Dalton R., Jr., Superv., Data Processing, Registration & Admissions 4 Peele; 1509 Westchester Rd.	2432	VA8-6581
*Harrison, Ernest, Jr., Res. Asst., Engr. Research 344 Riddick; 828 Greenwich St.	2340	828-6687
Harrison, Sylvia L., Steno., Zoology 155 Gardner; 112½ Sheppard St.	2631	834-2388
Hart, C. Arthur, Assoc. Prof., Wood Sci. & Tech. 156 Kilgore; 2636 Kilgore Ave.	2883	834-0402
*Hart, Clyde W., Asst. Director of Foundations, Foundations & Development 12 Holladay; 4115 Laurel Ridge Dr.	2846	787-2677
*Hart, Franklin D., Asst. Prof., Mechanical Engr. 282 Broughton; 6001 Hillsboro Rd.	2374	833-1110
*Hart, John R., Research Engineer, Industrial Extn. Service 1-B IES Building; 3230 Birnamwood Rd.	2359	833-2297
Hartley, Lodwick C., Professor & Head, English 118 Winston; 812 East Gardner Dr.	2462	832-6289
*Hartman, James P., Instructor, Mechanical Engr. 101 Broughton; Box 5432, State College Sta.	2366	832-7362
*Harvell, Ada L., Textile Lab. Tech., Textiles B-48 Nelson Textile; Rt. 3, Wake Forest	2565	833-8793
*Harvey, Paul H., Professor & Head, Crop Science 258 Williams; 1311 Mayfair Rd.	2647	TE2-0475
*Harwood, Dewey G., Jr., Extn. Prof., Extn. Economist, Agri. Econ. 18-F Patterson; 4404 Boxwood Rd., Laurel Hills	2611	787-1257
*Haskins, Walter F., Agri. Res. Asst., Crop Science 457 Williams; Rt. 7, Raleigh	2642	832-2192
*Hassan, Hassan A., Professor, Mechanical Engr. 315 Broughton; 4407 Gates St.	2372	787-1806

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Hassler, Francis J., Professor & Head, Agri. Engr. 102 Agri. Engr.; 1404 Eden Lane	2694	834-3257
*Hassler, William W., Assoc. Prof., Zoology 160 Gardner; 14 Bagwell Ave.	2741	834-1445
Hatton, Joanne C., Steno., Agri. & Life Sciences 120-F Patterson; 2342 Grant Ave.	2716	834-8988
Hauser, Linda L., Secretary, Liberal Arts 161 Harrelson; 101 Enterprise St.	2467, 2468	TE3-4014
*Hawkins, Gerald G., Asst. Director, Student Activities 202 Peele; 206 Northfield Dr.	2441	787-1426
*Hawkins, Ralph O., Games Supervisor, Erdahl-Cloyd Union Erdahl-Cloyd Union; 124 Brooks Ave.	2451	834-6597
*Hawks, Sterling N., Extn. Assoc. Prof., Crop Science 452 Williams; 18 Dixie Tr.	2641	TE3-0056
*Hawley, William H., Jr., Data Processing Oper., Computing Center 11-G Nelson Textile; 432 Wayne Dr.	2510, 2518	834-3289
*Hawthorne, Mark D., Asst. Prof., English 218-20 Winston; 1922 West Smallwood Dr.	2463	828-2476
*Hayes, Arthur C., Assoc. Prof., Textile Chemistry 105 David Clark Labs.; 302 Brooks Ave.	2551	TE2-3851
*Hayne, Don W., Professor, Experimental Statistics 613 General Laboratory; Route 3, Box 288A, Chapel Hill	2531	942-335
*Haynes, Frank L., Jr., Professor, Horticultural Science 208 Kilgore; 5720 Winthrop Dr.	2660	787-3147
*Haynie, Russell M., Jr., Director, Truck Driver Training, General Extension 113 1911 Building; 3800 Greenleaf St.	2263	834-6196
Haynie, Vickie C., Stenographer, Chemistry 113 Withers; 3800 Greenleaf St.	2538	834-6196
*Haywood, Edward G., Agri. Res. Asst., Animal Science 328 Polk; 612 Chamberlain St.	2773	833-1740
Haywood, Patsy J., Asst. to Dean, Graduate School 104 Peele; 2908 O'Berry St.	2871, 2872	833-6300
†Heard, Eulah V., Steno., Extn. Personnel Development 309 Ricks; 3109 Georgian Ter.	2707	833-9198
*Heater, Nell R., Business Manager, Wolfpack Club 108 Coliseum; 318 Robert St., Cary	2112	HO7-9114
*Heaton, Richard S., Assoc. Director, Erdahl-Cloyd Union Erdahl-Cloyd Union; 2615 Wells Ave.	2453, 2451	834-1909
*Hebert, T. T., Professor, Plant Pathology 205 Gardner; 718 Runnymede Rd.	2752	833-4208
*Hedrick, James L., USDA Agri. Economist, Agri. Econ. 213 1911 Building; 812 Peyton St.	2617	833-5264
*Heffner, Lawrence L., Adjunct Assoc. Prof., Textiles 212 David Clark Labs.; 2301 Gaddy Dr.	2561	787-1350
*Height, Jackie N., Clerk, Alumni Affairs 108 Alumni; 2400 Dove Ln.	2869, 2860	833-5961
*Heinbockel, John H., Instructor, Engr. Mechanics & Math. 119-A Riddick, 317 Harrelson; 3409 Cherry Ln.	2343, 2386	833-8655
*Heiser, Wilford C., Agri. Res. Asst., Animal Science 305 Polk; 914 Powell Dr.	2773	834-1785
*Hemphill, Gene, Key Punch Oper., Agri. Econ. 212 1911 Building; 3106 Douglas St.	2617	833-6320
*Hendley, William R., Asst. Prof., Economics 139 Harrelson; 604 Gardner St.	2472	TE2-5741
*Henderson, Geraldine S., Auditing Clerk, Animal Science Dairy Records Processing Center, Leazar; 1501 Kelly Rd., Garner	2632	362-1634

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Henderson, Nancy C., Agri. Res. Asst., Entomology 125 Gardner; 211 Jones-Franklin Rd.	2620	833-6812
Henderson, Warren R., Asst. Prof., Horticultural Science 316 Kilgore; 1601 Hillsboro St.	2660	TE2-6601
*Hendricks, Walter A., Adjunct Prof., Experimental Statistics Research Triangle Institute; P. O. Box 490, Durham; 801 Lake Boone Tr.	834-6246	787-4204
*Henkes, Ilse B., Typist, Entomology 333 Gardner; 6220 Myra Rd.	2748	828-2129
*Henry, Mabel H., Accounting Clerk, Business Affairs 10 Holladay; 1034 Pineview Dr.	2154	828-3835
*Henry, William R., Assoc. Prof., Agri. Econ. 12 Patterson; 1510 Ashburton Rd.	2603	834-0340
*Hentz, Forrest C., Jr., Asst. Prof., Chemistry 115 Withers; 816 Brent Rd.	2538	832-2253
Herbst, Laurence J., Asst. Prof., Experimental Statistics 604-D General Laboratory; 2442 Wade Ave.	2534	834-7058
*Herman, Luther R., Instructor, Electrical Engr. 302 Daniels; 1309 College Pl.		833-3580
*Hertzman, John, Asst. Prof., Design 103 Brooks; 1615 Ambleside Dr.	2204	TE2-6764
*Hester, Francis E., Assoc. Prof. & Director, Cooperative Fish. Unit, Zoology 218-J David Clark Labs.; 521 Northwood Dr.	2631	787-0418
Hester, Mary Frances, Secretary, Agri. Extn. 108 Ricks; 1426 Mordecai Dr.	2812	832-4530
*Hewitt, Clive L., Projects Director, ETV Educational Television Studio, 3117 Western Blvd.; 2118 Kipawa St.	2853	787-2754
*Hibbard, Wanda M., Agri. Res. Tech., Botany & Bacteriology 25 Gardner; 1101 Carolina Pines	2728	828-6650
Hicks, Carroll A., Library Asst., Catalog 109 Library; 3017 Grant Ave.	2841	TE3-3442
Hicks, Lynda F., Res. Asst., Entomology 330 Gardner; Rt. 3, Wake Forest	2748	EX5-5837
*Hicks, Mabel L., Library Asst., Reserve Room 210 Library; 2505 Vanderbilt Ave.	2845	833-3119
*Hicks, William N., Professor & Head, Philosophy & Religion 343 Harrelson; 2505 Vanderbilt Ave.	2477	TE3-3119
*Higgins, John E., Administrative Officer, Physical Plant 111 Morris; Rt. 8, Box 25, Raleigh	2181	834-5328
*Highfill, Uliss O., Res. Superv., Soil Science 188 Williams; 700 W. Pineland Dr.	2657	832-4457
*Highfill, W. Lawrence, Assoc. Prof., Philosophy & Religion 349 Harrelson; 220 East Park Dr.	2477	832-6903
*Hill, Charles H., Professor, Poultry Nutrition, Poultry Science 10 Scott; 1304 Lorimer Rd.	2628	828-7147
Hill, Delores L., Steno., Animal Science Animal Disease Lab.; 120 Woodburn Rd.	2738, 2739	832-3701
*Hill, Eugene F., Instructor, Electrical Engr. 229 Daniels; E-21 McKimmon Village		833-5213
*Hill, Helen T., Typist, Purchasing 102 1911 Building; Tara Apts. #51, 109 Ramblewood Dr.	2171	787-3334
*Hill, Mary C., Library Asst., Photocopy Service 205 Library; 718 Rosemont Ave.	2845	833-9378
Hill, Randolph I., Secretary, Crop Science 256 Williams; 2200 Hope St.	2647	832-3466
*Hill, Ruthie T., Statistical Aide, Experimental Statistics 510 General Laboratory; 201 Johnson Drive, Clayton	2541	WA2-7459

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Hill, Thomas A., Instrument Maker, Physics 103 Daniels; 424 Bashford Rd.	2505	833-8844
*Hilliard, Bobby G., Nursery Worker, Horticultural Science New Greenhouse; Box 29, Angier	2685	MU9-4177
*Hilliard, Garland K., Instructor, Freshman Engineering Division 273 Broughton; 716 Brooks Ave.	2387	VA8-7882
*Hilliard, Linda C., Key Punch Oper., Computing Center 11-G Nelson Textile; 225 Grand Ave.	2518	833-6977
*Hines, Thomas I., Professor & Head, Rec. & Park Admin. 103-A Field House; Leesville Rd.	2246, 2247	787-3595
*Hinnant, Hugh L., Agri. Res. Asst., Plant Pathology 111 Gardner; Rt. 1, Apex	1737	832-1366
*Hinnant, Marion L., Agri. Res. Asst., Crop Science Agronomy Headhouse; 349 W. Main St., Clayton	2640	922-7034
Hinson, Thelma L., Specialist, Home Management, Agri. Extn. 207 Ricks; Raleigh Apts.	2784	828-7990
*Hinton, Esther V., Typist, Business Affairs 205 Holladay; 1207 Park Ave., Garner	2120	EM2-4551
*Hirons, Kathleen P., Agri. Res. Tech., Animal Science 340 Polk; 3041 Lewis Farm Rd.	2773	834-6391
*Hisada, Alice M., Agri. Res. Asst., Plant Pathology 112 Gardner; Rt. #8, Box 51, Raleigh	2736	832-1008
*Hisada, Juan E., Res. Asst., Textiles B-5D Nelson Textile; Rt. 8, Box 51, Raleigh	2566	TE2-1008
*Hitchings, Robert G., Assoc. Prof., Pulp & Paper Tech. 106 Robertson Lab.; 3427 Redbud Ln.	2889	TE3-5517
*Hite, John L., Acting Electronics Shop Superv., Nuclear Reactor Project 20 Burlington Nuclear Lab.; Rt. 1, Godwin	2321	
*Hittmeier, Betty L., Agri. Res. Asst., Animal Science 241 Polk; 3032 Farrior Rd.	2763	828-6960
Hix, John, Asst. Prof., Architecture 313 Brooks; 2405 Glenwood Ave.	2203	828-6409
*Hoadley, George B., Professor & Head, Electrical Engr. 320-A Daniels; 3213 Leonard St.	2336	834-4524
*Hobbs, Alvah C., Maint. Man, Animal Science Central Research Station, Western Blvd.; 3532 Western Blvd.	2680	834-4702
*Hobbs, Anne M., Clerk, N.R.R.C. 505 Oberlin Road, Room 100; 418 Craven St., Durham	2866	477-4986
*Hobbs, LaFloyd H., Extn. Wood Products Specialist, Forestry 266 Kilgore; 4215 Galax Dr.	2892	787-1904
*Hobbs, Maie C., Statistical Clerk, Agri. Econ. 7 Patterson; 4215 Galax Dr.	2612	787-1904
*Hobbs, Winnifred, Agr. Res. Asst., Entomology 7 Withers; 328 Lattimer Rd.	2754	787-3314
*Hobby, Sally J., Typist, Phys. Sciences & Applied Math. 103 General Laboratory; 1403 Sycamore St.	2503	832-0250
*Hobgood, Thomas N., Jr., Extn. Asst. Prof., Community Development Specialist, Rural Soc. 239 1911 Building; 5612 Deblyn Dr.	2659	787-0227
*Hoch, Arthur M., Assoc. Prof., Physical Education Carmichael Gymnasium; 1307 College Pl.	2487	TE4-6988
Hodge, Brenda B., Data Processor, Business Office 2 Holladay; 709-C Daniels St.	2140	VA8-8325
Hodge, Chloe B., Secretary, Entomology 142 Gardner; 5017 W. Lakeside Dr.	2746	832-3547
Hodge, M. Glynne, Secretary, Education 119 Tompkins; Knightdale	2231	CO6-2240

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Hodge, Martha B., Key Punch Oper., Animal Science Dairy Records Processing Center, Leazar; 2308 Nelson St.	2632	833-6687
*Hodge, Winifred M., Secretary, School of Design 200 Brooks; 3301 Octavia St.	2202	832-8013
*Hodges, Charles S., Assoc. Prof., Plant Pathology 100 Gardner; 411 Pleasants Ave., Cary	2722	467-9824
*Hodgson, Ernest, Assoc. Prof., Entomology 138 Gardner; Rt. 8, Box 274A, Raleigh	2620	787-1642
Hogan, Gaynelle, Marketing Specialist, Agri. Econ. 18-D Patterson; 1034 Nichols Dr.	2664	828-7306
*Hoggard, David G., Agri. Res. Superv., Horticultural Science 210 Kilgore; 16 Horne St.	2660	TE4-3744
*Hogge, Lemuel C., Agri. Res. Asst., Soil Science 382 Williams; 2913 Boone Tr.	2649	828-8794
*Hofmann, Julius V., Director Emeritus, Forestry 164 Kilgore; 2800 Fairview Rd.	2884	TE2-2993
*Holcombe, Effie E., Secretary, Sports Information, Athletics 124 Coliseum; 1907 Glenwood Ave.	2102	833-7681
*Holden, Carror F., Accounting Clerk, Horticultural Science 118 Kilgore; 3333 Ocotea St.	2684	787-4850
*Holland, Bonnie B., Agri. Res. Asst., Plant Pathology 201 Gardner; Rt. 8, Box 49, Raleigh	2752	828-7308
*Holland, Martha B., Secretary, Forest Management 250 Kilgore; 311 Shepherd St.	2880	TE2-2556
*Hollahan, Eugene, Instructor, English 218-220 Winston; 3400 Avent Ferry Rd.	2463	828-3788
*Holland, John H., Dairy Plant Operator, Food Science Basement Polk; 704 Brigham Dr.	2700	TE4-6193
*Holland, Judith B., Clerk, Business Affairs B Holladay; 2705 Dorchester Ct.	2156	834-0008
*Holler, Dan F., District 4-H Club Agent, Agri. Extn. 204 Ricks; 3340 White Oak Rd.	2802, 2803	TE3-9301
*Holley, Daniel L., Wood Products Extn. Specialist, Forestry Extn. 55 Kilgore; Apt. Q-222, McKimmon Village	2892	828-8130
*Hollowell, M. E., District Agricultural Agent, Agri. Extn. Service 301-A Ricks; 3012 Randolph Dr.	2789	787-1464
*Holt, Dorothy B., Tel. Oper., Tel. Exch. 116 Winston; 511 Mills St.	0	833-0605
*Holt, Marie L., Steno., Soil Science 356 Williams; Box 234, Tunstall Ave., Apex	2649	354-6474
*Holton, Emily M., Agri. Res. Asst., Crop Science 114 Williams; 1025 Pineview Dr.	2638	833-1059
*Holtzman, Abraham, Professor, History & Political Science 115 Harrelson; 2522 Medway Dr.	2481	832-2142
*Homme, Henry A., Extn. Assoc. Prof., Extn. Economist, Agri. Econ. 201-E Patterson; 5137 West Lakeside Dr.	2606	834-3892
*Hon, William H., Instructor, Zoology 168 Gardner; 1307 Mayfair St.	2741	833-9915
*Honeycutt, Dorothy A., Steno., Pulp and Paper Tech. 104 Robertson Lab.; Rt. 1, 5932 Sandy Fork Rd.	2889	787-2655
*Honeycutt, Ruth B., Asst. Prof., Mathematics 327 Harrelson; 1827 Dixie Tr.	2386	TE2-5198
Hood, William C., Asst. Prof., Animal Industries 216 Page; 4106 Reavis Rd.	2378	832-4409
*Hoomani, Jafar, Instructor, Mathematics 220 Harrelson; 1008 Pond St., Cary	2385	467-1104
*Hoover, Dale M., Assoc. Prof., Agri. Econ. 215 Patterson; 360 Wilmot Dr.	2609	834-0086

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Hoover, Maurice W., Professor, Food Science 116 Kilgore; 3620 Merwin Rd.	2691, 2692	TE2-7742
*Hopkins, Anne W., Key Punch Unit Supervisor, N.R.R.C. 505 Oberlin Road, Room 100; Box 124, Knightdale	2866	CO6-2800
Hopkins, Sheila A., Steno., Business Affairs B Holladay, 1345 Canterbury Rd.	2144	833-9163 or 832-9898
*Horgan, Patricia H., Agri. Res. Asst., Crop Science 402 Williams; 1417 N. King Charles Rd.	2635	828-4359
*Horn, J. William, Assoc. Prof., Civil Engr. 309 Mann; 3515 Andrews Ln.	2353	787-4539
*Horton, Donald B., Asst. Prof., Zoology 218-F David Clark Labs.	2741	
*Horton, Frank R., Agri. Res. Asst., Animal Science Animal Husbandry Farm; Rt. 1, Knightdale		CO6-2262
*Horton, H. Robert, Asst. Prof., Chemistry 203 Withers; 2704 Barmettler St.	2524	834-5312
*Horvitz, Daniel G., Adjunct Professor, Experimental Statistics Research Triangle Institute, P. O. Box 490, Durham; 3115 Eton Rd.	834-6246	828-4901
*Hostetler. Earl H., Prof. Emeritus, Animal Science 2524 White Oak Rd.		832-5794
*Hostetler, Ivan, Professor & Head, Industrial Arts 106 Tompkins; 2604 Van Dyke Ave.	2237	TE3-0796
*House, Charles E., Agri. Res. Asst., Crop Science 429 Williams; Rt. 1, Knightdale	2642	266-2140
*House, Elizabeth P., Steno., Textiles 106 Nelson Textile; Rt. 1, Princeton	2575, 2576	936-5650
*Houser. Gloria W., Head, Serials 12 Library; 1903 Clark Ave.	2842	TE4-6149
*Howard, Elaine C., Textile Lab. Tech., Textiles B-45 Nelson Textile; 2918 Holly Springs Rd.	2558	VA8-3827
*Howder, Colonel James D., USAF, Professor, Aerospace Studies 145 Coliseum; 3618 Corbin St.	2317, 2318	787-3678
*Howell, Ezra L., Assoc. Prof., Agri. Engr. 149 Agri. Engr., 1414 Walnut Tr.	2662	TE4-0808
*Howle, Betty S., Key Punch Oper., Animal Science Dairy Records Processing Center—Leazar; E-13 McKimmon Village	2632	828-8747
*Hoyle, George W., Instructor, Electrical Engr. 133 Daniels; Rt. 8, Box 35A		834-8655
*Hoyle, Patsy L., Secretary, Home Management, Agri. Extn. 207 Ricks; P-309 McKimmon Village	2784	828-9816
Huang, Barney K., Asst. Prof., Agri. Engr. 153 Agri. Engr.; 508 Cutler St.	2662	833-9175
Hudson, Linda C., Addressograph Oper., Alumni Affairs 106 Alumni; 1205 Lakeside Dr., Garner	2869, 2860	362-9966
*Huffman, Daniel R., Statistical Analyst, Genetics 112 Williams; 612 King Richard Rd.	2638	832-1126
Hughes, Carolyn G., Catalog Editor, Information Services 202 Holladay; 1859 W. Smallwood Dr.	2874, 2875	TE4-1941
*Hughes, George R., Extn. Instructor, Horticultural Science 227 Kilgore; P. O. Box 3515 College Station Head Residence Counselor's Quarters, Syme Dorm.	2686, 2687	TE4-2493
*Hughes, Patricia B., Secretary, Highway Res. Program, Civil Engr. 308 Mann; Rt. 1, Garner	2353, 2354	362-9205
*Humphries, Ervin G., Asst. Prof., Agri. Engr. 124 Agri. Engr.; 1323 Ridge Rd.	2681	787-4079

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Hunsinger, Kenneth E., Data Processor, N.R.R.C. 505 Oberlin Road, Room 100; 515 Jones Franklin Rd.	2866	832-0896
Hunt, Alice M., Instructor, Economics 126 Harrelson; 103 Laurel Hill Cr., Chapel Hill	2472	
*Hunt, R. Ivan, Agri. Res. Asst., Plant Pathology 204 Gardner; Rt. 5, Raleigh	2752	CO6-2606
*Hunter, A. H., Visiting Assoc. Prof., Soil Science (AID) 101 Williams; USAID/Uruguay, American Embassy, Montevideo, Uruguay	2630	
Hunter, Lillian P., Accounting Clerk, Experimental Statistics 112 General Laboratory; 525 N. East St.	2528	832-6084
*Hutchins, Edward B., Sergeant, USA, Militiary Science 154 Coliseum; 3804 Kelly St.	2427	828-5349
*Hutchison, Elvan E., Res. Asst. Prof., Textiles B-21 Nelson Textile; 2407 Stafford Ave.	2564	833-1091
*Huxter, William T., Jr., Wood Products Extn. Specialist, Forestry 266 Kilgore; 308 E. Rowan St.	2892	787-0689
*Hyatt, George, Jr., Professor, Animal Science & Director, Agri. Extn. Service 102 Ricks; 1419 Lutz Ave.	2812	833-9541
*Hyman, Theodore (Ted) M., Extn. Asst. Prof., Agri. Info. 315 Ricks; 3734 Swift Dr.	2806, 2809	828-9462

I

*Ihnen, Loren A., Asst. Prof., Agri. Econ. 220 Patterson; 5021 Dunbar Rd.	2610	834-9627
*Ingram, William P., Asst. Prof., Chemistry 220 Withers; 419 Chesterfield Rd.	2539	TE2-8947
*Inscore, Preston L., Textile Res. Tech., Textiles 303 Nelson Textile; 146 Summit Ave.	2560	TE2-2872
*Itoh, Makoto, Visiting Prof., Mathematics & Electrical Engr. 227 Daniels, 337 Harrelson; 2609 Vanderbilt Ave.	2386	834-8620
*Ivey, Ruth L., Steno., Food Science 126 Polk; 602 Oakwood Ave.	2796	832-1223

J

†Jackson, Dorothy A., Steno., Poultry Science 210 Scott; 2405 Mayview Rd.	2621	832-6126
*Jackson, Merrill D., Instructor, Entomology 7 Withers; 3046 Lewis Farm Rd.	2754	834-9929
*Jackson, Vivian P., Statistical Analyst, Experimental Statistics 510 General Laboratory; Millbrook	2541	TE2-7358
*Jackson, William A., Professor, Soil Science 354 Williams, 238-A Buck Jones Rd.	2637	828-5646
*James, Becky S., Secretary, Agri. Extn. 212 Ricks; 1616 Bruce Cr.	2787	834-7800
*James, H. Brooks, Dean, Agriculture & Life Sciences, Professor, Agri. Econ., Agri. Admin. 115 Patterson; 1323 Lutz Ave.	2613, 2615	TE4-1585
*James, Paula W., Agri. Res. Asst., Soil Science 331 Williams; 1000 Brooks Ave.	2636	828-4297
*Jansen, Edward F., Instructor, Agri. Econ. 209 1911 Building; 5124 West Lakeside Dr.	2617	832-5631
*Jayne, Benjamin A., Professor, Wood Sci. & Tech. 62 Kilgore; 4517 Gates St.	2887	787-0794

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Jefferies, Susan H., Statistical Analyst, Genetics 343-F Gardner; 3002 Medlin Dr.	2704	828-3809
*Jenkins, J. M., Professor, Horticultural Science Castle Hayne Castle Hayne, N. C.	675-2314	675-2392
*Jennings, Harley Y., Visiting Res. Prof., Textile Chemistry 115 David Clark Labs.; 2400 Ridge Rd.	2554	787-4586
*Jennings, Peter R., Visiting Prof., Crop Science 114 Williams; 812 Rosemont	2638	787-4564
*Jewett, Richard L., Assoc. Prof., Industrial Extn. Service B-3 IES Building; 720 Lake Boone Tr.	2358	787-0218
Jin, Chia R., Res. Asst., Textile Chemistry 2 David Clark Labs.; 1601 Ridge Rd.	2563	787-3213
*Johns, Kingston, Jr., Financial Aid Officer, Counseling 205 Peele; 201 Lord Berkeley Rd.	2421	TE4-5859
*Johnson, Albert B., Research Assistant, Agri. Econ. 16 Patterson; Memory Lane, Millbrook	2603	833-9472
*Johnson, Brenda W., Textile Lab. Tech., Textiles B-48 Nelson Textile; 603½ Dixie Tr.	2565	
*Johnson, Camilla C., Clerk, Agri. Admin. 120-J Patterson; 2744-A Rosedale Ave.	2714, 2715	834-7450
*Johnson, Carol H., Craft Shop Director, Erdahl-Cloyd Union Frank Thompson Craft Shop; 3921 Arrow Dr.	2457	834-1401
*Johnson, Dorothy F., Steno., Horticultural Science 130 Kilgore; Memory Lane, Millbrook	2683	TE2-8140
*Johnson, Elmer H., Professor, Soc. & Anthro. 356 Harrelson; 2921 Arrow Dr.	2491	787-4135
*Johnson, J. Clyde, Assoc. Prof., Psychology 224 Tompkins; 2602 Wade Ave.	2252	832-1724
*Johnson, James M., Dairy Hand, Animal Breeding, Animal Science College Dairy Farm; College Dairy Farm	2674	
*Johnson, James T., Agri. Res. Asst., Plant Pathology 106 Gardner; Rt. 3, Zebulon	2736	269-8516
Johnson, John M., Asst. Reference Librarian, Reference 122 Library; Box 996, Chapel Hill	2844	942-3686
*Johnson, Joyce B., Steno., Plant Pathology 116 Gardner; 808 Brigham Rd.	2737, 2735	VA8-8610
*Johnson, Lee E., Bookkeeper, A.R.A. Slater Leazar Hall; Rt. 1, Box 117, Garner	2878, 2879	
*Johnson, Margaret P., Secretary, Agri. Extn. Clothing 304 Ricks; 402 W. Park St., Cary	2783	467-9181
Johnson, Mary P., Steno., Crop Science 128 Williams; G-2 Raleigh Apts.	2638	828-3950
Johnson, Nancy S., Secretary, Chancellor's Office A Holladay; 1329 Brooks Ave.	2191	787-5237
*Johnson, Paul R., Assoc. Prof., Agri. Econ. 210 Patterson; 5228 Melbourne Rd.	2600	828-6639
*Johnson, William H., Asst. Prof., Agri. Engr. 118 Agri. Engr.; 3731 Swift Dr.	2682	832-8628
*Johnson, William J., Agri. Res. Asst., Animal Science Central Research Station, Western Blvd.; 3616 Western Blvd.	2680	832-0038
*Johnson, Vernon W., Agri. Res. Asst., Plant Pathology 106 Gardner; Rt. 2, Pine Acres, Clayton	2736	
*Johnston, Bruce G., Visiting Lecturer, Civil Engr. 400 Mann; 3208 Darien Dr.	2332	787-4349
*Johnston, Henry W., Planning Asst., Facilities Planning Division Watauga, West Entrance; 211 Woodburn Rd.	2121	828-2860
Johnston, Mary E., Library Asst., Serials 12 Library; 2113 Glenwood Ave.	2842	833-8784

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Johnston, William R., Instructor, Chemistry 109 Withers; 127 West Park Dr.	2545	TE3-0697
*Jolly, Frances A., Nurse, Student Health Service Clark Infirmary; 108 E. Whitaker Mill Rd.	2410	
*Jones, Christine V., Steno., Agri. Education 123 Tompkins; Q-209 McKimmon Village	2234	
*Jones, Duke Y., Offset Press Foreman, Print Shop Print Shop; 302 O'Neil St., Clayton	2132	WA2-6590
*Jones, E. Walton, Extn. Asst. Prof., Extn. Economist, Agri. Econ. 220 Patterson; Rt. 5, Timberlake	2723	833-9106
*Jones, Edward M., Forest Management Ext. Specialist, Extension Forestry 260 Kilgore; Rt. 3, Tarboro	2891	TA3-3425
*Jones, Edwin L., Agri. Res. Superv., Crop Science 480-D Williams; Rt. 4, Raleigh	2644	828-2742
*Jones, George D., Extn. Prof., In Charge, Entomology Extn., Entomology 141 Gardner; 1316 Westfield Ave.	2703	833-9324
*Jones, Guy L., Professor, Crop Science 480-B Williams; 3435 Blue Ridge Rd.	2644	787-4564
*Jones, Ivan D., Professor, Food Science 116 Kilgore; 2710 Rosedale Ave.	2691, 2692	TE2-3091
*Jones, J. C., Head, Forest Management Ext. Section, Extn. Forestry 260 Kilgore; 3203 Ruffin St.	2891	828-3617
*Jones, James B., Res. Instructor, Education 203 Tompkins; 2603 Wells Ave.	2249	834-8826
*Jones, James R., Extn. Asst. Prof., Extn. Animal Husb. Spec., Animal Science Box 3027, Wilson	Wilson 243-2900	
*Jones, Jeannette T., Data Processor Mgr., Animal Science Dairy Records Processing Center, Leazar; 2810 Fowler St.	2632	834-3990
Jones, Louis A., Assoc. Prof., Chemistry 213 Withers; 3026 Lewis Farm Rd.	2538	833-7969
Jones, Margaret A., Accountant-Clerk, Poultry Science 125 Scott; C-201 Boylan Apts.	2627	833-6723
*Jones, Marion L., Extn. Asst. Prof., Nutrition, Poultry Science 216 Scott; 2717 Western Blvd.	2621	834-3026
*Jones, Victor A., Asst. Prof., Food Science 128D Polk; 121 Crest Rd., Cary	2794	467-9217
Jordan, Frances, Family Life Specialist, Agri. Extn. 306 Ricks; 2411 Stafford Ave.	2784	834-5452
*Jordan, Kenneth A., Assoc. Prof., Agri. Engr. 135 Agri. Engr.; 1633 Walnut Tr.	2663	TE4-4639
*Jordan, Leon T., Instructor, Metallurgical Engr., Mineral Industries 104 Page; 10 Bagwell	2377	TE4-5424
*Jordan, Walter E., Assoc. Prof. Emeritus, Chemistry 301 Withers; 2600 Mayview Rd.	2545	TE2-3574
Joshi, Pooran C., Res. Assoc., Botany & Bacteriology 257 Gardner; 1507 Ambleside Dr.	2725	832-7054
*Joyner, Phyllis M., Key Punch Oper., Animal Science Dairy Records Processing Center, Leazar; 621 Powell Dr.	2632	833-6146

K

*Kahn, Charles H., Assoc. Prof., Architecture 314 Brooks; 215 Hillcrest Rd.	2203	TE2-5394

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Kahn, Joseph S., Asst. Prof., Botany, Botany & Bacteriology 225 Gardner; 1127 Delano St., Durham	2726	682-8347
*Kamphoefner, Henry L., Dean, School of Design 200-A Brooks; 3060 Granville Dr.	2201	787-2698
*Kamprath, Eugene J., Professor, Soil Science 330 Williams; 1211 Ashburton Rd.	2636	833-2286
Kanipe, John T., Jr., Asst. Director, Student Housing 203 Peele; 2707½ Vanderbilt Ave.	2406, 2642	TE4-2792
*Kaplan, Adele, Agri. Res. Tech., Animal Science Animal Disease Lab.; 929 St. Mary's St.	2738, 2739	833-2993
*Kappelman, Albert J., Instructor, Crop Science 129 Williams; 2701 Broadwell St.	2638	834-9583
*Kare, Morley R., Professor, Poultry Physiology, Poultry Science, Zoology Sensory Physiology Lab., Poultry Research Farm, College Rd. 2204 Barfield Ct.	2822	787-4295
*Kashef, Aziz I., Visiting Prof., Civil Engr. 420 Mann; 1910 Smallwood Dr.	2332	828-6817
*Katzin, Gerald H., Asst. Prof., Physics 410 F General Laboratory; 1220 Bickett Rd.	2513	787-3480
Kearsey, M. J., Res. Assoc., Genetics 360 Gardner; 602 S. Boylan Ave.	2731	
*Keating, Harold, Assoc. Prof., Physical Education Carmichael Gymnasium; 2709 Royster Rd.	2487	TE4-1571
*Keaton, John A., Agri. Res. Superv., Crop Science 453 Williams; 3814 Woodside Rd.	2642	834-4861
*Keblawi, Faysal S., Instructor, Electrical Engr. 225 Daniels; 3810 Sherman Ave.		828-2400
*Keener, Donald S., Head, Circulation 106 Library; 3411 Leonard St.	2845	828-9774
*Keith, Jane B., Steno., Engineering 232 Riddick; 403 Wayne Dr.	2315	833-8931
*Keller, Anna P., Clerk, Admissions & Registration 107 Peele; 3105 Ruffin St.	2433	828-3000
*Keller, Kenneth R., Asst. Director, In Charge Tobacco Res., Agri. Admin. 106 Patterson; Rt. 4, Raleigh	2718	467-1586
*Keller, Walter M., In Charge Forestry Extension 264 Kilgore; 3105 Ruffin St.	2891	828-3000
*Kelley, Jack, Extn. Prof., In Charge, Extn. Animal Husbandry, Animal Science 116 Polk; 625 Woodburn Rd.	2761	833-4719
Kellison, Jim, Asst. Artist, Agri. Information 13 Ricks; 3429 Holly Springs Rd.	2862	
Kellison, Robert C., Liaison Geneticist, Forest Management 250 Kilgore; 2404 Clark Ave.	2880	828-7824
Kelly, A. Wilton, Asst. Manager, Print Shop Print Shop; Rt. 6	2132	787-0165
*Kelly, Harry C., Dean of the Faculty A Holladay; 613 Macon Pl.	2192, 2193	787-2778
*Kelly, Joseph W., Professor, Poultry Nutrition, Poultry Science 11 Scott; 1624 Dixie Tr.	2628	833-6877
*Kelly, Colonel Lem M., USA, Professor, Military Science 154 Coliseum; 5412 Parkwood Dr.	2428, 2429	787-3837
*Kelman, Arthur, William Neal Reynolds Distinguished Professor & Professor, Forest Management, Plant Pathology 3 Gardner; 2310 Weymouth Ct.	2722	787-4468

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Kemper, Joel J., Visiting Extn. Animal Husbandry Advisor, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Kendrick, Berdie B., Typist, Botany & Bacteriology 146 Gardner; 350 Wilmot Dr.	2725	832-0646
*Kenfield, Carol H., Clerk, Student Publications King Building; 2707 Mayview Rd.	2412	VA8-3243
*Kenfield, John F., Jr., Assoc. Prof., Physical Education Carmichael Gymnasium; 2701 Mayview Rd.	2487	VA8-3243
*Kennedy, Frank R., Utilities Supt., Physical Plant Power Plant; 2634 St. Mary's St.	2181	787-3275
*Kennedy, Patricia J., Agri. Res. Asst., Forestry 250 Kilgore; Rt. 8, Box 35, Raleigh	2880	TE4-1374
Kennett, Nell I., State Home Economics Leader, Agri. Extn. 103 Ricks; 1436 Banbury Rd.	2781, 2782	832-7533
*Kent, Billy E., Contract & Grants Auditor, Business Affairs 10 Holladay; 3605 Donna Rd.	2154	TE3-9124
*Kenyon, Joe M., Res. Asst., Crop Science 480-C Williams; 5708 Waycross St.	2644	TE4-4996
*Kepler, Carol R., Visiting Res. Asst. Prof., Animal Science 342 Polk; 5104 Melbourne Rd.	2773	828-5074
*Keppler, William E., Jr., Extn. Prof., Forestry Extension 266 Kilgore; 5001 Newcastle Rd.	2892	VA8-9583
*Kessler, Linda L., Steno., Experimental Statistics 608 General Laboratory; 1938 Bernard St.	2534	834-3363
*Kesterson, David B., Asst. Prof., English 215 Winston; 3012 Farrior Rd.	2463	834-8051
*Ketner, Terry B., Agri. Res. Asst., Animal Breeding, Animal Science	2759	
*Kiger, Linda B., Accounting Clerk, Agri. Admin. 118 Patterson; 313 Lakeside Dr.	2714	362-5461
Kiker, Ellar S., Steno., Poultry Science 210 Scott; 209 Gardner St.	2621	834-7132
*Kim, Chun, Res. Superv., Poultry Science 10 Scott; 426 Waldo St., Cary	2628	467-1954
*Kincheloe, Henderson G., Professor, English 113 Winston; 210 Furches St.	2464	833-8459
*King, Cyrus B., Head, Acquisitions 113 Library; 409 Yarmouth Rd.	2841	834-1287
King, Ethel R., Accounting Clerk, Business Affairs 10 Holladay; 809-C Daniels St.	2154	TE3-9135
*King, Hubert G., Maintenance Mech., Mechanical Engr. 1 Broughton; 5931 Woodcrest Dr.	2374	833-1445
*King, James A., Res. Instructor, Textiles B-21 Nelson Textile; 5128 Jeffries Rd.	2564, 2565	832-8660
*King, Julia S., Stenographer, Chemistry 102 Withers; Rt. 3, Raleigh	2549	362-9578
*King, R. A., Professor, Agri. Econ. 201-F Patterson Hall; 2108 Buckingham Rd.	2606	
*King, Richard A., Professor in Agri. Economics, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*King, Virginia B., Steno., Agron. Extn., Crop Science 456 Williams; 3106 Ashel St.	2641	787-1091

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Kilburn, S. Collins, Congregational Friends Chaplain, Student Affairs 286 Hillsboro; 1110 Dogwood Ln.	832-1119	828-6017
*Killian, Harold O., Sergeant Major, USAF, Aerospace Studies 145 Coliseum; 5407 Dillard Dr.	2317, 2318	828-3062
*Kirby, Rosa D., Instructor, Textile Chemistry 1 David Clark Labs.; 2816 Everett Ave.	2555	834-2500
*Kirk, Bettye K., Agri. Res. Asst., Crop Science 402 Williams; N-14 McKimmon Village	2635	832-8887
*Kirkland, J. Bryant, Dean, Education 119 Tompkins; 2621 Grant Ave.	2231, 2232	TE2-2308
*Kirkman, Horace C., Sergeant, USAF, Aerospace Studies 145 Coliseum; 810 E. Pineland Dr.	2317, 2318	833-2651
Kitchin, Stedman, Jr., Instructor, Modern Languages 312 Harrelson; 604-C Smedes Pl.	2475	834-7560
Klekas, Margaret W., Secretary, Erdahl-Cloyd Union Erdahl-Cloyd Union; 3019 Mayview Rd.	2451, 2454	833-5600
*Klibbe, James W., Academic Coord. & Asst. Prof., Textiles 126 Nelson Textile; 1213 Brooks Ave.	2568	832-0995
*Kline, David M., Assoc. Prof., USDA, Plant Pathology 204 Gardner; 2627 Fairview Rd.	2752	TE4-4738
*Kling, Bobbie C., Steno., Poultry Science 120 Scott; Q309 McKimmon Village	2626	834-1526
*Klingman, Glenn C., Professor, Crop Science 464 Williams; 1013 Gardner St.	2651	833-1498
*Knappenberger, H. Allan, Instructor, Industrial Engr. 342 Riddick; 3153 Ward Rd.	2362	TE4-5928
*Knight, George F., Instructor, Mathematics 220 Harrelson; 2327 Lyon St.	2385	828-2246
*Knight, Joy S., Clerk, Rural Soc. 332 1911 Building; 504 N. Blount St.	2701	832-1030
*Knight, Richard B., Professor, Mechanical Engr. 223 Broughton; 3005 Eton Rd.	2369	828-7071
*Knott, Betty F., Secretary, Music 104 Pullen; 306 Middleton Ave., Cary	2401	467-1283
*Knott, Fred N., Extension Asst. Prof., Dairy Husb., Animal Science 104B Polk; 809 Ravenwood Dr.	2771	834-2425
*Knowles, A. Sidney, Jr., Asst. Prof., English 11 Winston; 3403 Leonard St.	2461	834-5307
*Koch, Annalise K., Library Asst., Reference 122 Library; 1500 Pineview Dr., Garner	2844	362-1668
*Koh, Kwangil, Asst. Prof., Mathematics 234 Harrelson; 819 Merrie Rd.	2384	833-0063
*Kojima, Ken-ichi, Professor, Genetics 343-L Gardner; 1422 Ridge Rd.	2733	787-4375
*Kolb, Charles F., Asst. Prof., History & Political Science 104 Harrelson; 313 Loop Rd., Garner	2481	362-9837
*Kolbe, Melvin H., Extn. Prof., Horticultural Science 229 Kilgore; 3026 Devonshire Dr.	2686, 2687	TE3-6246
*Konsler, Thomas R., Asst. Prof., Horticultural Science 717 Buncombe St., Hendersonville	Hendersonville 692-1630	692-4784
Koonce, Benjamin G., Assoc. Prof., English 15 Winston; 222 Hawthorne Rd.	2461	832-5120
*Kovac, Teddy S., Statistical Clerk, Agri. Econ. 7 Patterson; D-1A Cameron Court Apts.	2612	832-4445
*Krayn, Ruth, Agri. Res. Superv., Crop Science 405 Williams; K-11 McKimmon Village	2635	832-4549

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Kreem, Martha U., Agri. Res. Asst., Soil Science 306 Williams; 1429 N. King Charles Rd.	2636	828-7886
*Kriegel, W. Wurth, Professor-in-Charge Ceramic Engr., Mineral Industries 109 Page; 1916 Sunset Dr.	2377	VA8-5597
*Kripalani, G. K., Instructor, Agri. Econ. 303 1911 Building; O-16 McKimmon Village	2616	834-4782
*Krueger, Cary L., Animal Science Dairy Records Processing Center, Leazar; 3015 Leonard St.	2632	833-9978
*Krueger, Sue J., Steno., Crop Science 480 Williams; 3015 Leonard St.	2644	833-9978
*Kugler, Carol, Secretary, Tobacco Literature Service 234 Library; P. O. Box 595, Cary	2705	467-1254
*Kurylo, William, Instructor, Philosophy & Religion 348 Harrelson; 113 Mallette St., Chapel Hill	2477	942-4225
*Kushman, Leaton J., Senior Plant Physiologist, USDA, Assoc. Prof., Horticultural Science 222 Kilgore; 827 Griffis St., Cary	2660	467-1849

L

*Lade, Robert W., Asst. Prof., Electrical Engr. 431 Daniels; 2705 Rothgeb Dr.	2308	828-5926
*LaGarde, Jerry M., Head Cashier, Business Affairs B Holladay; 4405 Revere Ct.	2129	787-3239
†Lambe, Claude M., Asst. Prof. Emeritus, Civil Engr. 413 Calvin Rd.		832-6565
*Lambert, John R., Professor, Social Studies 148 Harrelson; Hermitage, Rt. 2, Raleigh	2479	EM2-9289
*Lamm, Cecilia S., Library Asst., Photocopy Service 205 Library; 1500½ Simpkins St.	2845	828-6193
Lamm, Emily C., Secretary, Zoology 162 Gardner; 808 N. Blount St., Apt. 13	2741	828-9743
*Lammi, Eleanor H., Counselor, Counseling 207 Peele; 1516 Pineview Dr.	2424	834-4163
*Lammi, J. O., Professor, Forest Economics 270 Kilgore; 1516 Pineview Dr.	2885	834-4163
*Lampe, J. Harold, Dean Emeritus, Engineering 5402 Studeley Ave., Norfolk, Va.		627-8273
*Lancaster, Forrest W., Professor, Physics 405 General Laboratory; 2403 Everett Ave.	2515	TE2-6316
*Land, Major Joe E., Jr., USA, Asst. Prof., Military Science 154 Coliseum; 935 Hillview St., Cary	2428, 2429	467-5662
*Landes, Chester G., Asst. Prof., Pulp and Paper Tech. Robertson Lab.; 3212 Queens Rd.	2889	787-1589
Landis, Carole J., Secretary, Agri. Econ. 220 Patterson; 1109 Nichols Dr.	2724	828-5339
*Lane, James H., Instructor, Civil Engr. 417 Mann; 4815 Dillard Rd.	2333	828-9710
*Lane, Judy G., Typist, Entomology 325 Gardner; 219 Q McKimmon Village	2748	828-7933
*Langfelder, L. Jay., Asst. Prof., Civil Engr. 214 Mann; 4708 Lakemont Dr.	2332	787-3706
*Langley, Doris L., Accounting Clerk, Business Affairs 7 Holladay; 1103 Lakeside Dr., Garner	2130	362-9484
Langley, Lorna, District Home Economics Agent, Agri. Extn. 203 Ricks; 312 West Drewry Ln.	2788	833-3513

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Langston, William E., Res. Asst., Poultry Science 30 Scott; 2205 Gilliam Ln.	2628	828-8629
*LaNier, Brenda V., Auditing Clerk, Animal Science Dairy Records Processing Center, Leazar; 2802 Mayview Rd.	2632	828-8304
*Larson, Roy A., Asst. Prof., Horticultural Science 124 Kilgore; 5004 W. Lakeside Dr.	2683	833-3778
†Lassiter, Lela B., Steno., Animal Science 232 Polk; Center St., Apex	2763	EL4-2891
*Lassiter, Louie T., Asst. Prof., Textiles 301 A Nelson Textile; 2606 Wells Ave.	2578	832-6057
*Latham, Katie G., Secretary, Rural Soc. 340 1911 Building; 333 Meredith St.	2702	TE3-6234
*Lawson, Major James E., Asst. Prof., Military Science 154 Coliseum; 921 Hillview St., Cary	2428, 2429	467-9973
League, E. Anne, Steno, Engineering 223 Riddick; 122 Hillcrest St.	2313	834-7173
*Leatherwood, James M., Res. Asst. Prof., Animal Science 245 Polk; 3412 Leonard St.	2773	828-2158
*Lecce, James G., Professor, Animal Science Animal Disease Lab.; 2219 Garden Pl.	2738, 2739	828-6630
*Ledbetter, Thomas B., Asst. Prof., Mechanical Engr. 222 Broughton; 3201 Ruffin St.	2360	833-5274
*Lee, John H., Textile Res. Tech., Textiles 303 Nelson Textile; 202 Compton St., Clayton	2560	WA2-7595
*Lee, John W., General Foreman, Print Shop Print Shop; 258 Hardee St., Clayton	2132	WA2-6565
*Lee, Joshua A., Assoc. Prof., Crop Science 466 Williams; 5104 Newcastle Rd.	2651	828-3563
*Lee, Lexene T., Typist, Erdahl-Cloyd Union Erdahl-Cloyd Union; 258 Hardee St., Clayton	2451, 2453	WA2-6565
Lee, Mary Em., Clothing Specialist, Agri. Extn. 300 Ricks; D-5 Raleigh Apts.	2783	TE3-9332
*Lee, Patricia P., Accounting Clerk, Phys. Sciences & Applied Math. 113 General Laboratory; 2719 Avent Ferry Rd.	2501	828-8017
*Lee, Sung W., Res. Instructor, Textiles B2-A Nelson Textile; 1004 Marilyn Dr.	2569	834-3306
*Lee, William D., Assoc. Prof., Emeritus, Soils 318 Furches St.		832-3930
*Legates, James E., Prof. & Head Animal Breeding, Animal Science 231 Polk; 1333 Walnut Tr.	2768	834-1302
*Lehman, Edward C., Jr., Asst. Prof., Soc. & Anthro. 350 Harrelson; 411 W. Cornwall Rd., Cary	2491	467-1268
*Lehman, Samuel G., Prof. Emeritus, Plant Pathology 113 Gardner; 123 Brooks Ave.		832-8764
*Leith, Carlton J., Assoc. Prof. Geological Engr., Mineral Industries 210 Page; 5717 Deblyn Dr.	2378	787-3208
†Lentz, Virginia P., Steno., Textiles 109 David Clark Labs.; 2771 Toxey Dr.	2551	VA8-6761
*Leonard, Barbara F., Accounting Clerk, Business Affairs B Holladay; 2705-A Gordon St.	2144	833-7001
Leonard, Bobby E., Instructor, Nuclear Engr. 236 Riddick	2304, 2321	
*Leonard, Ralph A., Res. Instructor, Soil Science 312 Williams; 609 Mills St.	2636	834-4894
*Leonhardt, Arnold D., Agri. Res. Asst., Animal Breeding, Animal Science 231 Polk; Rt. 2, Vale	2768	RE5-2998

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
Leonhardt, William R., Asst. Prof., Physical Education Carmichael Gymnasium; 3410 Hillsboro St.	2487	
*Leslie, Patricia G., Steno., Animal Science 319 Polk; E-14 McKimmon Village	2773	833-6184
*Levanthal, Gerald S., Asst. Prof., Psychology 226 Tompkins; 356 Wilmot Dr.	2252	833-0184
*Levine, Jack, Professor, Mathematics 225 Harrelson; 2731 Rosedale Ave.	2385	834-0876
*Levine, Rabbi Joseph H., Jewish Chaplain, Stu. Aff., Chapel Hill 210 W. Cameron Ave., Chapel Hill	942-4057	968-5931
*Levine, Samuel G., Assoc. Prof., Chemistry 102 Withers; 1609 Ward St., Durham	2549	489-9257
*Levings, Charles S., Asst. Prof., Genetics 343-D Gardner; 5101 Liles Rd.	2704	828-9911
*Lewis, Charles F., Asst. Prof., Mathematics 211 Harrelson; 218 E. Park Dr.	2381	TE3-4539
*Lewis, Frances C., Secretary, Athletics 115 Coliseum; 504 Heater Dr., Cary	2101	HO7-9138
*Lewis, Joyce H., Library Asst., Acquisitions 112 Library; 502 Devereaux St.	2841	833-4480
*Lewis, Luther E., Instrument Maker, Nuclear Reactor Project 7 General Laboratories; 710 Colleton Rd.	2508	TE3-1118
*Lewis, Malcolm, Instructor Emeritus, Mechanical Engr. 1002 Trinity Ave., Durham		
*Lewis, William M., Assoc. Prof., Crop Science 284 Williams; 4725 Rembert Dr.	2648	787-1088
Li, Peter D., Res. Instructor, Textiles 133 Nelson Textile; 919 Tower St., Apt. 2	2573	834-9011
*Leiberstein, H. Melvin, Professor, Mathematics 316 Harrelson	2386	362-1719
*Liles, Edith W., Steno., Textiles 103 Nelson Textile; 316 Hudson St.	2578	832-0881
*Liles, Frances L., Secretary, Forestry 162 Kilgore; 1705 Athens Ave., Pineview Hills	2883	834-2455
*Lind, Thomas C., Instructor, Textiles 120 Nelson Textile; 611 Beaver Dam Rd.	2572	828-4552
*Lindsay, Penny H., Steno., Industrial Extn. Service 4 IES Building; 1619 Van Dyke Ave.	2357	828-9716
Lineberry, Martha F., Head Catalog Librarian, Catalog 109 Library; 203 Forest Rd.	2841	833-1347
*Liner, Hugh L., Extn. Instructor, Extn. Economist, Agri. Econ. 209-B Patterson; 358 Meredith St.	2724	833-8294
*Link, David A., Asst. Prof., Agri. Engr. 107 Agri. Engr.; 1415 Duplin Rd.	2695	832-5423
*Linnerud, Ardell C., Post-doctoral Fellow, Experimental Statistics 518-E General Laboratory; 1202 Banbury Rd.	2541	833-1602
*Litchford, Marguerite J., Secretary, Student Housing 203 Peele; 2616 Wells Ave.	2642	828-7076
*Little, Helen W., Data Processing Oper., Computing Center 11-G Nelson Textile; Rt. 2, Clayton	2518	922-7631
*Little, James H., Asst. Prof., Physical Education Carmichael Gymnasium; Rt. 6, Leesville Rd.	2487	787-0577
*Little, Lillie B., Extension Housing & House Furnishing Specialist, Agri. Extn. 211 Ricks; 3601 Alamance Dr.	2785	787-0404
*Littleton, Isaac T., Acting Director, Library 126 Library; 4813 Brookhaven Rd.	2843	787-4786

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
Liu, C. Y., Asst. Prof., Agri. Econ. 4-A Patterson	2607	
*Livengood, Charles D., Res. Asst., Textile Chemistry 15 David Clark Labs.; Rt. 4, Raleigh	2555	828-9841
*Livengood, Mary B., Steno., Purchasing 108-1911 Building; Rt. 4, Raleigh	2171	828-9841
*Llewellyn, Robert W., Professor, Industrial Engr. 342 Riddick; 213 Ellwood Rd.	2362	787-2592
Locklear, Dorothy, Steno-Clerk, Agri. Information 317 Ricks; 416 Normandy St., Cary	2806	467-9957
*Loeppert, Richard H., Professor, Chemistry 113 Withers; 1317 Rand Dr.	2546	TE3-6531
*LoMonte, Vincent J., Photographer, Textiles B-46 Nelson Textile; 2836 Claremont Ave.	2566	
*London, Linda L., Steno., Food Science 128C Polk; F-24 McKimmon Village	2795, 2794	828-8075
*Long, G. Gilbert, Assoc. Prof., Chemistry 19 Withers; 2608 Mayview Rd.	2548	VA8-4952
Long, Linwood, Asst. Military Property Custodian, Military Supply Frank Thompson Bldg.; 1004 Glenwood Ave.	2427	TE2-6487
*Long, Robert W., Extn. Asst. Prof., Community Development Specialist, Rural Soc. 238 1911 Building; 519 Barksdale Dr.	2659	TE4-0958
*Long, W. Earl, Planning Asst., Facilities Planning Division West Entrance, Watauga; 423 Breeze Rd., Cary	2121	467-1780
*Lose, Elizabeth D., Agri. Res. Tech., Animal Breeding, Animal Science Reproductive Physiology Lab.; 116 E. Park Dr.	2673	834-6545
*Love, Joseph W., Extn. Asst. Prof., Horticultural Science 231 Kilgore; 5209 W. Lakeside Dr.	2686, 2687	828-8941
*Lovvorn, Roy L., Director of Res., Agri. Admin. 105 Patterson; 809 Runnymede Rd.	2717, 2710	834-4993
*Lowe, Rone P., Asst. Editor, Agri. Information 120 Ricks; 1100 Dogwood Lane	2804	828-6768
*Lubow, Robert E., Asst. Prof., Psychology, Zoology Sensory Physiology Lab., Poultry Res. Farm; 1311 Crabapple Ln.	2822	832-2064
*Lucas, George B., Professor, Plant Pathology 109 Gardner; 3040 Churchill Rd.	2736	832-0346
*Lucas, Henry L., Professor, Experimental Statistics 513-F General Laboratory; 2612 St. Mary's St.	2541	787-2699
†Lucas, Julia, Library Asst., Reserve Room 210 Library; 2713 Kilgore Ave.	2845	TE4-9422
*Lucier, Arthur E., Res. Assoc., Engr. Research 9 Riddick; 704 Runnymede Rd.	2348	TE2-6856
Lutz, J. Fulton, Professor, Soil Science 224 Williams; 1401 Dixie Tr.	2643	787-6678
*Lynch, Walter K., Res. Assoc., Textiles 303 Nelson Textile; 1113 Dogwood Ln.	2560	834-3871
*Lynn, Joseph T., Assoc. Prof. & Acting Head, Physics 105 General Laboratory; 400 Lake Boone Tr.	2521, 2522	TE2-3798
†Lyons, Harrye B., Librarian, School of Design 201 Brooks; U-2 Raleigh Apts.	2207	TE2-4125
*Lytton, Victor H., Extn. Dairy Hus. Specialist, Animal Science Dairy Records Processing Center, Leazar; 5144 Circle Dr.	2632	833-4807

---

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
M		
*Mackerracher, Robert A., Asst. Prof., Mathematics 217 Harrelson; 2708 Webb St.	2385	TE2-4197
*Macon, John A., Chemical Engineer, Industrial Extn. Service B-2 IES Building; 312 Shepherd St.	2358	833-5342
*Maday, Clarence J., Asst. Prof., Engr. Mechanics 224 Riddick; 26 East Rowan St.	2343	787-3318
*Maddock, Stephen J., Asst. Prof., Forest Management 71 Kilgore; 705 Dixie Tr.	2887	833-0666
*Maddox, James G., Professor, Agri. Econ. 220-A Patterson; Box 266, Rt. 6, Raleigh	2610	787-3695
Maddry, Linda C., Secretary, Mathematics 255 Harrelson; 713 New Rd.	2382, 2383	832-5797
Mahon, Barbara J., Secretary, Tobacco Literature Service 234 Library; Rt. 6, Loop Road North	2705	787-0289
*Main, Alexander R., Assoc. Prof., Entomology 7 Withers; 821 Bickett Rd.	2754	787-0306
*Main, Charles E., Asst. Prof., Plant Pathology Oxford Tobacco Research Station, Oxford; 4312 Yadkin Dr.	Oxford 5822	787-4446
*Maki, T. Ewald, Head, Forest Management 152 Kilgore; 1511 Duplin Rd.	2885	832-2588
*Maller, Owen, Visiting Asst. Prof., Zoology Sensory Physiology Lab., Poultry Res. Farm; 1818 Park Dr.	2822	828-3711
*Maller, Rosalie G., Secretary, Agri. Econ. 203 Patterson; 2518 Clark Ave.	2605	828-3711
*Malpass, Major Gerald D., USAF, Asst. Prof., Aerospace Stud. 145 Coliseum; 4804 Lakemont Dr.	2417, 2418	787-3263
*Maltbie, Armstrong, Asst. Prof., Mathematics 206 Harrelson; 2829 O'Berry St.	2381	833-9151
*Mann, Ann A., Typist, Experimental Statistics 518 General Laboratory; 2204 Brewer St.	2541	828-3761
*Mann, Carroll L., Jr., Director, Facilities Planning Div. & Professor, Civil Engr. West Entrance, Watauga; 1412 Canterbury Rd.	2121	TE4-3932
*Mann, Thurston J., Professor & Head, Genetics 353 Gardner; 710 Runnymede Rd.	2731	833-9883
*Manning, Edward G., Assoc. Prof., Electrical Engr. 425 Daniels; 2913 Anderson Dr.	2337	834-3007
*Manning, Elizabeth H., Instructor, Chemistry 110 Withers; 1306 Rand Dr.	2547	TE3-6931
*Manring, Edward R., Professor, Physics 411 General Laboratory; 1601 Dixie Tr.	2513	832-5469
*Maravich Press, Asst. Basketball Coach, Athletics 102 Coliseum; 508 N. Glenn Dr.	2105	787-0773
*March, Elsa W., Secretary, Rural Soc. Extn. 241 1911 Building; 1426 Park Dr.	2659	833-7293
*Marcum, Bettye, Secretary, Agri. Econ. 211 1911 Building; 509 Grove Ave.	2617	828-3701
*Markantonatos, Antony, Mechanical Engr., Food Science Basement Kilgore; Apt. 6, 106 Faircloth St.	2691, 2692	834-6826
*Markman, Leona S., Typist, Psychology 228 Tompkins; Q-311 McKimmon Village	2249, 2254	834-4591
*Marks, Margaret W., Secretary, Erdahl-Cloyd Union Erdahl-Cloyd Union; 1601 Fairview Rd.	2451, 2452	832-9578
*Marlin, Joe A., Instructor, Mathematics 338 Harrelson; 1437 Beaver Dam Dr.	2386	828-3632

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
†Marr, Rosemary S., Accounting Clerk, Textiles 115 David Clark Labs.; 207 Gary St.	2554	832-7377
*Marsh, C. Paul, Assoc. Prof., Rural Soc. Extn. 328 1911 Building; 1213 Duplin Rd.	2701	834-4694
*Marshall, Henry V., Jr., Res. Asst., Botany & Bacteriology 422-A Williams; 5120 Kaplan Dr.	2642	833-1394
*Marshall, Roger P., Prof. Emeritus, English 13 Winston; 1512 Park Dr.	2461	832-5297
*Marsland, David B., Assoc. Prof., Chemical Engr. 106 Riddick; 205 Forest Rd.	2325	828-7688
*Martin, Carter W., Asst. Prof., English 209 Winston; 3417 Octavia St.	2463	834-0411
*Martin, Claire S., Secretary, Physical Plant 200 Morris; 102 Horne	2181	832-8977
*Martin, Clifford K., Extn. Asst. Prof., Soil Man., Soil Science 155 Williams; 412 Dixie Tr.	2654	834-3917
*Martin, David H., Asst. Prof., Physics 317 General Laboratory; 820 Merrie Rd.	2511, 2525	TE4-0013
*Martin, Donald C., Asst. Prof., Chemical Engr. 201 Riddick; 820 Carlisle St.	2326	834-4438
*Martin, Grady A., Asst. Prof., Poultry Genetics, Poultry Science 203 Scott; 3405 Ruffin St.	2623	833-6792
*Martin, LeRoy B., Jr., Asst. Prof., Mathematics 331 Harrelson; 3001 Raleigh-Durham Highway	2386	787-3610
*Martin, Nancy B., Steno., Textile Chemistry 115 David Clark Labs.; 2227 Noble Rd.	2553, 2555	834-5574
*Martin, Thomas J., Jr., Asst. Prof. Emeritus, Mechanical Engr. 2401 Stafford Ave.		TE3-8044
*Martin, William R., Jr., Adjunct Asst. Prof., Textiles Research Triangle; 526 Heater Dr., Cary	Durham 549-8141	HO7-9946
*Martof, Bernard S., Head, Zoology 155 Gardner; 2705 Trawick Rd.	2741	828-3304
*Marvin, Katie, Secretary, Zoology 160 Gardner; 2315 Churchill Rd.	2741	832-6527
*Mason, David D., Professor & Head, Experimental Statistics 110 General Laboratory; 3245 Lewis Farm Rd.	2528	787-4324
†Mason, Edna Belle, Secretary, Civil Engr. 208 Mann; 113½ Chamberlain St.	2331	832-3994
Mason, Eleanor H., Secretary, Agri. Extn. 101 Ricks; Boylan Apts., F 201	2781, 2782	832-9675
*Mason, James I., Asst. Director, General Extension 136 1911 Building; 1324 Lutz Ave.	2265	828-3634
*Massenburg, Johnsye E., Secretary, Counseling 207 Peele; 2240 The Circle	2424	TE2-5931
*Massengill, Jo H., Steno., Textiles B-21 Nelson Textile; 513 Raleigh St., Fuquay Springs	2564, 2565	687-5436
*Massey, Frances W., Instructor, Textiles B-49 Nelson Textile; 1301 Fairfax Dr.	2558	828-8128
*Massey, Shirley B., Key Punch Oper., Computing Center 11-G Nelson Textile; 505 Ranch Farm Rd.	2518	828-7727
*Mathia, Gene A., Visit. Asst. Prof. in Agri. Economics, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Matrone, Gennard, Res. Prof., Animal Science 339 Polk; 1333 Duplin Rd.	2773	833-5584
*Matthews, Joseph C., Instructor, Agri. Econ. 213 1911 Building; 4706 Western Blvd.	2617	833-8095

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
Matthews, N. F. J., Asst. Prof., Electrical Engr. 427 Daniels; 1904 Smallwood Dr.	2337	828-0473
*Matthews, Vellie F., Jr., Photographer, Agri. Information 3 Ricks; 140½ N. Lord Ashley Rd.	2862	834-4736
*Matthias, Martha F., Res. Asst., Forest Management 254 Kilgore; 1621 Beaver Dam Dr.	2880	TE2-2134
*Mattox, John D., Photographer, Agri. Information 1 Ricks; 305 Wall St., Wendell	2862	365-5231
*Matzinger, Dale F., Professor, Genetics 343-K Gardner; 3256 Lewis Farm Rd.	2733	787-4720
Mauney, Ann, Clerk, Admissions and Registration 112 Peele; 1218 Chaney Rd.	2431, 2437	832-4312
*Mauney, Dianne R., Secretary, Animal Science 105 Polk; P. O. Box 5073, Raleigh	2771	467-1729
*Mauney, Jack R., Assoc. Prof., Crop Science 487 Williams; 2608 Van Dyke Ave.	2652	833-5825
*May, Eulis L., Jr., Agri. Res. Superv., Horticultural Science Horticultural Greenhouse; Box 118, Rt. 5, Raleigh	2685	CO6-2315
*Maynard, Frances B., Auditing Clerk, Animal Science Dairy Records Processing Center, Leazer; Rt. 3, Box 109, Apex	2632	354-6071
*Mayo, Selz C., Prof. & Head, Rural Soc. & Soc. & Anthro. 341 1911 Building, 361 Harrelson; 2520 Greenway Ave.	2702- 2491	834-7944
*McBrayer, Elizabeth M., Steno., Extn. Animal Husbandry 111 Polk; 223 Forest Rd.	2762	832-0479
*McBryde, Phil, Agri. Res. Tech., Food Science 132 Polk; 806 Lawndale, Garner	2795	362-9420
*McCabe, Eugene F., Agri. Res. Asst., Genetics 6 Gardner; 3821 Western Blvd.	2722	833-9539
*McCabe, Warren L., Visiting Prof., Chemical Engr. 121 Riddick; 222 Ransom St., Chapel Hill	2324 ~~2329~~	942-2020
*McCalister, Donald V., Asst. Prof., Soc. & Anthro. 350 Harrelson; 215 Boundary St., Cary	2491	467-9575
*McCann, Glenn C., Prof. in Rural Sociology, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*McCants, Charles B., Professor, Soil Science 424 Williams; 1000 Powell Dr.	2645	834-0585
McCarson, Annette Y., Typist, Institute of Biol. Sci. 101 Patterson; 3123 Stanhope Ave.	2665	828-8939
*McClain, Nathaniel C., Res. Asst., Poultry Science 30 Scott; 400 New Rand Rd., Garner	2628	362-9918
*McClure, William F., Instructor, Agri. Engr. 116 Agri. Engr.; 828 Merrie Rd.	2682	833-8927
*McCollum, Robert E., Asst. Prof. in Soil Sci., Agri. Mis. to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*McCombs, Clarence L., Professor, Horticultural Science 220 Kilgore; 3438 Bradley Pl.	2660	TE4-2482
*McConnell, Norman J., Res. Superv., Poultry Research Farm, Poultry Science Poultry Research Farm; 1403 College Rd.	2729	833-4788
*McCracken, Ralph J., Professor & Head, Soil Science 222 Williams; 834 Ralph Dr., Cary	2655, 2656	467-1233
*McCollough, Hilliard B., Assistant, Athletics 115 Coliseum; 3719 Swift Dr.	2101	834-2127
*McDonald, Donald, Asst. Prof., Civil Engr. 409 Mann; 1831 W. Smallwood Dr.	2332	832-8666

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*McDonald, Hugh D., Instructor, Civil Engr. 419 Mann; 4205 Fayetteville Rd.	2332	828-6813
*McDonald, John W., Asst. to the Director, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*McDonald, Katherine O., Steno., Mechanical Engr. 211 Broughton; 508 Sampson Pl.	2365, 2366	787-1178
*McDonald, Lee R., Jr., Asst. Program Director, Erdahl-Cloyd Union Erdahl-Cloyd Union; 2904 O'Berry St.	2454, 2451	828-3250
†McDonald, Mabel P., Accounting Clerk, Agri. Extn. 120-C Patterson; 1905 McDonald Lane	2601	832-9920
†McDonald, Mary D., Secretary, Agri. Extn. 212 Ricks; 2807 Bedford Ave.	2785	TE4-1474
*McDonald, Patrick H., Professor & Head, Engr. Mechanics 325 Riddick; 1502 Walnut Tr.	2341, 2342	TE3-1039
*McGalliard, Ac R., Asst. Reference Librarian, Reference 122 Library; 408 Glascock St.	2844	TE2-7126
*McElwee, Robert L., Dir., Hardwood Research Program, Forestry 59 Kilgore; 510 Heater Dr., Cary	2887	HO7-9273
*McEntire, Selma H., Steno., Experimental Statistics 614 General Laboratory; 130-C Cox Ave.	2531	828-9995
McGee, Curtis D., Agri. Res. Asst., Crop Science 182 Williams; 17 Enterprise St.	2657	TE3-7697
McGee, Danford L., Agri. Res. Asst., Entomology 325 Gardner; Rt. 3, Box 151, Benson	2748	894-4493
*McGee, Floyd G., Agri. Res. Asst., Horticultural Science 128 Kilgore; Rt. 1, Box 164, Garner	2683	362-9965
*McGee, John C., Instructor, Chemical Engr. 306 Riddick; 906 Canterbury Rd.	2327	828-9850
*McGlamery, Edith B., Extension Housing and House Furnishings Specialist, Agri. Extn. 211 Ricks; 210 Wilmot Dr.	2785	TE4-9604
*McGlamery, Neal, Methodist Chaplain, Student Affairs 2501 Clark Ave.; 210 Wilmot Dr.	833-1861	834-9604
*McGuire, R. L., Extn. Asst. Prof., Animal Science Polk; Dept. of Animal Science, Uni. of Kentucky, Lexington, Ky.		
*McIntosh, Violet E., Steno., Genetics 353 Gardner; 614 Stacy St.	2731	833-5748
*McIntyre, Martin L., Agri. Res. Superv., Horticultural Science New Greenhouse; 1206 Onslow Rd.	2685	TE4-0490
*McKee, A. J., Agri. Res. Asst., Animal Breeding, Animal Science Dairy Farm; 2418 Sunnybrook Rd.	2674	828-7936
*McKee, Lowry L., Res. Asst. Technologist, Experimental Statistics 513-D General Laboratory; 800 Merrie Rd.	2541	828-3021
*McKenzie, Fred F., Visit. Prof. in Ani. Sci., Agri. Mis. to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*McKnight, Willie, Farm Hand, Animal Science Central Res. Station, Western Blvd.; Method	2680	
*McLamb, Ralph D., Agri. Res. Tech., Animal Science Animal Disease Lab.; 707 King St., Cary	2738, 2739	HO7-1226
*McLaughlin, Foil W., Asst. Director, N. C. Crop Improvement 193 Williams; 804 Runnymede Rd.	2851	TE4-1166
*McLaurin, Winborne R., Res. Asst., Wood Products Hodges Lab.; 513 Mayfair St., Cary	2881	
*McLawhorn, Phyllis J., Steno., Agri. Extn. 4-H Club 200 Ricks; 319 Williams St., Cary	2801	467-1560

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*McLean, DeVon W., Res. Asst., Soil Science 408 Williams; Holly Springs, N. C.	2645	687-5817
McLean, Grayce, Accounting Clerk, Business Affairs 3 Holladay; 15 Enterprise St.	2139	828-4282
McMillan, Martha M., Steno., Agri. Extn. 4-H Club 202 Ricks; 1804 Oberlin Rd.	2801	TE3-3745
*McMillen, R. W., Mgr., N. C. Foundation Seed Producers, Inc. 124 Williams; 3008 Grant Ave.	2821	834-2919
*McNeill, Jean C., Secretary, Agri. Education 123 Tompkins; Rt. 8, Blue Ridge Rd.	2234	787-4133
McNeill, John J., Res. Asst. Prof., Animal Science 343 Polk; 312 East Forest Dr.	2773	833-8589
*McVay, Francis E., Professor, Experimental Statistics 612-B General Laboratory; 3119 Darien Dr.	2531	834-8067
*McVay, Julie G., Instructor, Mathematics 333 Harrelson; 3119 Darien Dr.	2386	
*Meares, Jefferson S., Professor, Physics 406 E General Laboratory; 2408 Everett Ave.	2515	TE2-4594
*Mears, John M., Jr., Offset Composition Foreman, Print Shop Print Shop; 425 Lansing St.	2132	828-6328
*Megla, Gerhard K., Adjunct Prof., Electrical Engr. 3609 Anclote Pl.		787-0712
*Memory, Jasper D., Assoc. Prof., Physics 410 B General Laboratory; 3000 Warren Ave.	2513	832-0788
*Menius, Arthur C., Jr., Dean, Phys. Sci. & App. Math. 115 General Laboratory; 541 Hertford St.	2501, 2502	787-3520
*Mercer, Samuel, Electronic Comp. Programmer, Exper. Statistics 612-A General Laboratory; N-25 McKimmon Village	2531	
†Merritt, Emily W., Accounting Clerk, Business Affairs 4 Holladay; P-4 Raleigh Apts.	2149	832-1002
Merritt, Kenneth E., Res. Analyst, Experimental Statistics 5 0 General Laboratory; 130 Hawthorne Rd.	2541	
*Mettler, Lawrence E., Assoc. Prof., Genetics 350 Gardner; 1122 Franklin Rd.	2734	832-1605
*Metzger, Robert S., Assoc. Prof., Social Studies 155 Harrelson; 2721 Van Dyke Ave.	2479	VA8-3424
*Mezynski, Stanley, Glass Technologist, Physics 203 Daniels; 1209 N. King Charles Rd.	2505	828-0270
*Michaels, Albert P., Asst. Football Coach, Athletics 115 Coliseum; 415 Forsyth St.	2101	787-3256
*Middleton, Gordon K., Prof. Emeritus, Crop Science 193 Williams; 2817 Mayview Rd.	2851	TE4-9690
*Middleton, Henry M., Asst. Prof., Textiles 133 Nelson Textile; 2208 Creston Rd.	2573	833-8636
*Middleton, J. Leonard, Assoc. Prof., Philosophy & Religion 348 Harrelson; 903 Runnymede Rd.	2477	TE2-7205
*Middleton, James I., Mgr. Dairy Plant, Food Science Basement Polk; Rt. 1, Garner	2700	EM2-9684
*Miles, Marion L., Asst. Prof., Chemistry 102 Withers; 4021 Huckleberry Dr.	2549	787-3352
*Milholland, Robert D., Asst. Prof., Plant Path. Horticultural Crops Res. Station, Castle Hayne; 4025 Gillette Dr., Wilmington	Castle Hayne 675-2314	762-3834
*Miller, Betty H., Agri. Res. Tech., Animal Science Animal Disease Lab.; 5211 Asbury Cir.	2738, 2739	833-7656
*Miller, Conrad H., Assoc. Prof., Horticultural Science 212 Kilgore; 5121 Kaplan Dr.	2660	828-3148

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Miller, Darrell A., Asst. Prof., Crop Science 282 Williams; 2800 Bedford Ave.	2648	828-9432
Miller, David L., Statistical Analyst, Genetics 343-F Gardner; 1340 Duplin Rd.	2704	828-6863
*Miller, E. L., Jr., Assoc. Prof. Emeritus, Geological Engr., Mineral Industries 502 Carolina Ave.		TE4-3800
*Miller, Elizabeth R., Agri. Res. Tech., Food Science 212 Polk; 701 Chappell Dr.	2778	834-2402
*Miller, Grover C., Assoc. Prof., Zoology 361 Gardner; 822 Union St., Cary	2741	467-1380
*Miller, Howard G., Professor & Head, Psychology 201 Tompkins; 3421 Churchill Rd.	2251	834-7498
*Miller, John F., Faculty Emeritus, Physical Education 2504 Van Dyke Ave.		TE2-5823
*Miller, Latham L., Assoc. Prof., Rec. & Park Admin. 103-B Field House; 820 Lake Boone Tr.	2246	787-4464
*Miller, Mitzi G., Res. Instructor, Chemistry 15 Withers; 1103 Parker St.	2548	828-2977
*Miller, Norman C., Extn. Asst. Prof., Food Science 116 Kilgore; 5153 Jeffries Rd.	2691, 2692	833-8234
*Miller, Patricia B., Steno., Entomology 232 Gardner; 3548 Apache Dr.	2745	828-3792
*Miller, Philip A., Professor, Crop Science 462 Williams; 3015 Devonshire Rd.	2652	834-4290
*Miller, Raymond J., Asst. Prof., Soil Science 360 Williams; 208 Merwin Rd.	2637	832-7824
*Miller, Ruby T., Clothing Specialist, Agri. Extn. 302 Ricks; 1002 Lakeside Dr., Garner	2783	362-1917
*Miller, Texton R., Asst. Prof., Agri. Education 121 Tompkins; 808 Ralph Dr., Cary	2235	467-9015
*Miller, William D., Prof. Emeritus, Silviculture 1907 Victoria Rd.		TE2-1066
†Mills, Lucy T., Key Punch Oper., Admissions & Registration 4 Peele; 3320 Ruffin St.	2432	TE2-8188
Mills, Ralph A., Photographer, Agri. Information 1 Ricks; 2737 Toxey Dr.	2862	832-2669
*Mills, William C., Jr., Extn. Assoc. Prof., In Charge Poultry Extension, Poultry Science 211 Scott; Rt. 2, Apex	2621	354-6694
*Milton, Judy P., Steno., Animal Science 220 Polk; Rt. 1, Box 190, Lillington	2763	893-4142
*Mims, Agnes M., Auditing Clerk, Animal Science Dairy Records Processing Center, Leazar; 712 Grove Ave.	2632	833-9119
*Mincey, Leslie T., Gym & Equipment Superv. Physical Education Carmichael Gymnasium; 509 So. Lakeside Dr.	2487	VA8-2160
*Mintz, Colin S., District Agricultural Agent, Agri. Extn. Service 307 Ricks; 305 Woodburn Rd.	2780	TE3-8586
*Mistric, Walter J., Assoc. Prof., Entomology 236 Gardner; 4008 Avent Ferry Rd.	2745	833-1879
*Mitchell, Adolphus, Professor, Engr. Mechanics 318 Riddick; 3609 Bellevue Rd.	2342	TE4-7658
Mitchell, Alice J., Accounting Clerk, Business Affairs 5 Holladay; 1605 Fairview Rd.	2130	TE2-9600
*Mitchell, Lou W., X-ray Tech., Student Health Service Clark Infirmary; 2701 Dorchester Ct.	2410	832-1417
†Mitchell, Mary Frances, Personnel Clerk, Physical Plant 111 Morris; 605 N. Blount St.	2181	833-1396

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Mitchell, Theodore B., Prof. Emeritus, Entomology 325 Gardner; 1007 W. Peace St.	2748	832-6967
*Mitchem, Beckie B., Secretary, A.R.A. Slater Leazar Hall; Apt. Q-110, McKimmon Village	2877, 2879	832-7746
*Mochrie, Richard D., Assoc. Prof., Animal Science 242 Polk; 505 S. Dixon, Cary	2763	467-1552
*Moeller, Carl A., Asst. Prof., Industrial Arts 109 Tompkins; 405 Furches St.	2237	TE4-5437
*Moll, Robert H., Assoc. Prof., Genetics 343-J Gardner; 5908 Woodcrest Dr.	2704	832-1696
*Moncol, Daniel J., Asst. Prof., Animal Science Animal Disease Lab.; 1500 Powell Dr.	2738, 2739	828-6080
*Monk, Barbara S., Typist, Business Affairs B Holladay; 1501 St. Patrick Dr.	2156	TE3-1052
*Monroe, Robert J., Professor, Experimental Statistics 604-F General Laboratory; 838 Woodburn Rd.	2530	TE4-7763
*Montgomery, Camilla W., Typist, Agri. Engr. 137 Agri. Engr.; 404 Robin Hood Dr.	2662, 2663	TE3-6483
*Moon, Seung G., Visiting Prof., Rural Soc. 337 1911 Building; 19 Daisy St.	2702	VA8-5300
*Moore, Frank H., Assoc. Prof., English 112 Winston; 3705 Camley Ave.	2464	787-4400
*Moore, Harry B., Asst. Prof., Entomology 339 Gardner; 5128 Wickham Rd.	2748	834-5035
Moore, Jack D., Res. Assoc., Food Science 16 Polk; 1216 Franklin Rd.	2777	833-6016
*Moore, James L., Asst. Prof., Animal Science 245 Polk; 1501 Dixie Tr.	2763	832-0821
*Moore, Joyce B., Agri. Res. Tech., Food Science 139 Polk; 3509 Fayetteville Rd.	2795	
*Moore, Martha A., Secretary, Physics 104 General Laboratory; 3208 Dell Dr.	2521, 2522	VA8-2700
*Moore, Richard A., Head, Landscape Architecture 200-C Brooks; 301 Hillcrest Rd.	2202	828-7798
*Moore, Robert P., Professor, Crop Science 122-A Williams; 2619 Van Dyke Ave.	2638	832-6881
Moore, Royall T., Asst. Prof., Botany, Botany & Bacteriology 251 Gardner; 224½ E. Park Dr.	2725	834-5647
*Morehead, Charles G., Assoc. Prof., Occupational Info. & Guidance 206 Tompkins; 2517 Wake Dr.	2244	TE3-5491
*Moreland, Charles G., Asst. Prof., Chemistry 20 A Withers; 628 Ralph Dr.	2548	834-2787
*Moreland, Donald E., Assoc. Prof., Crop Science 483-A Williams; 1508 Powell Dr.	2652	833-7628
*Morelock, Margaret P., Textile Lab. Tech., Textiles B-45 Nelson Textile; Apt. G-23 McKimmon Village	2558	VA8-0438
*Morgan, Everett H., Maintenance Supt., Wood Products Hodges Lab.; Rt. 8, Box 150	2881	787-4534
*Morgan, John W., Instructor, Chemistry 115 Withers; 2614 Van Dyke Ave.	2538	TE2-8608
*Morris, Edith C., Agri. Res. Asst., Entomology 7 Withers; 3806 Burt Dr.	2754	
*Morris, Iris W., Typist, Agri. Information 320 Ricks; Box 207, Rt. 8, Raleigh	2808	787-1194
Morris, Maidred J., Asst. Editor, Home Economics, Agri. Infor. 316 Ricks; 815-D Daniels St.	2805, 2809	832-6964
*Morris, Owen F., Supervisor, Cafeteria, A.R.A. Slater Erdahl-Cloyd Union Dining Service; 4524 Revere Dr.	2279, 2270	787-0976

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Morris, Thomas B., Extn. Assoc. Prof., Specialist, Poultry Science 215 Scott; 1003 Gardner St.	2621	833-0568
*Morrison, Bessie W., Agri. Res. Asst., Crop Science 402 Williams; 203½ Brooks Ave.	2635	832-2185
*Morrison, Ilona T., Secretary, Animal Science 104 Polk; 704 Holden St.	2771	833-7449
Moser, Mary Sue, District 4-H Club Agent, Agri. Extn. 206 Ricks; 833-A Daniels St.	2802, 2803	TE4-1239
*Moser, William E., Assoc. Prof., Textiles 201 Nelson Textile; 3316 Lake Boone Tr.	2578	787-4680
*Moses, J. Harold, Instructor, Rec. & Park Admin. 103-E Field House; 2612 Barmettler St.	2246	833-0085
*Moss, Claude W., Res. Assoc., Food Science 128A Polk; Six Forks Rd.	2794	787-1782
*Moss, Marvin K., Asst. Prof., Physics 410D General Laboratory; 3320 Rock Creek Rd.	2513	TE4-4872
*Motley, Margaret A., Steno., Forestry 162 Kilgore; 118 Hawthorne Rd.	2883	TE2-4116
*Mount, Darl A., Instructor, Survey Entomologist, Entomology 137 Gardner; 3709 Randell Rd.	2703	834-9989
*Moyer, Samuel E., Asst. Geneticist, Genetics 343-H Gardner; 905 Beaver Dam Rd.	2704	832-3107
*Mozingo, Roy W., Res. Asst., Crop Science 480-D Williams; 3306 Hillsboro St.	2644	833-8588
*Mudge, Althea B., Accounting Clerk, Business Affairs 11 Holladay; 1909 Alexander Rd.	2158	TE2-1230
Mudge, Harley L., Technical Analyst, Industrial Extn. Service 2 IES Building; 1909 Alexander Rd.	2359	TE2-1230
*Mumford, Carey G., Professor, Mathematics 224 Harrelson; 712 Brooks Ave.	2385	832-5315
Mundy, Jeannean E., Steno., Alumni Affairs 105 Alumni; Rt. 4, Raleigh	2869, 2860	832-7162
*Murley, W. Ray, Professor, Animal Science 232-B Polk; 206 Furches St.	2763	834-4897
*Murphy, Charles F., Asst. Prof., Crop Science 118 Williams; 820 Richmond St.	2638	787-1907
Murray, Cleo, Office Manager, Laundry Laundry; I-2 Grosvenor Gardens	2122	TE3-2490
*Murray, Frank J., Asst. Prof., Physical Education Carmichael Gymnasium; 1415 Brooks Ave.	2487	TE2-1920
*Murray, Raymond L., Professor & Head, Nuclear Engr. 5 Burlington Nuclear Labs.; Box 5596, State College Sta.	2302, 2303	787-0960
*Musselwhite, Raymond, Asst. Prof., Design 117-A Brooks; 812 Merrie Rd.	2204	834-8931
*Musser, Glenn E., Contracts and Grants Officer, Business Affairs 10 Holladay; 3109 Brentwood Rd.	2154	VA8-3053
*Myatt, Peggy N., Key Punch Oper., N.R.R.C. 505 Oberlin Road, Room 100; 1220 Somerset Rd.	2866	832-4191
†Myers, Elizabeth F., Chemist, Textiles 1 David Clark Labs.; 415 Dixie Tr.	2563	832-7015
Myers, Guy A., Instructor, Engr. Mechanics 143-C Riddick; 1037 St. Mary's St.	2343	834-3724
*Myers, Osborne, Records Asst., Animal Science Dairy Records Processing Center, Leazar; 4608 Lattimer Rd.	2632	787-2230
*Myers, Richard M., Asst. Prof., Animal Breeding, Animal Science 231 Polk; 325 Shepherd St.	2768	834-1289

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
N		
*Nagle, Janice R., Library Asst., Acquisitions 112 Library; 2201½ Saint Mary's St.	2841	833-4245
*Nahikian, Howard M., Professor, Mathematics 203 Harrelson; 3116 Leonard St.	2383	833-4709
*Namkoong, Gene, Res. Asst. Prof., Genetics & Forestry 343-H Gardner, 71 Kilgore; 2706 Barmettler St.	2704, 2887	TE4-8850
*Nance, Ann M., Library Asst., Serials 12 Library; 2903 Raleigh-Durham Highway	2842	787-3726
*Nash, Thomas L., Instructor Emeritus, Mechanical Engr. 1626 Park Dr.		TE2-8182
*Nave, Wallace K., Extn. Instructor, Extn. Economist, Agri. Econ. 18 D Patterson; 1322 Duplin Rd.	2611	833-0839
*Neal, Alene W., Clerk, Agri. Information 3 Ricks; 301 Cedar St.	2862	832-7190
*Neal, Marion B., Accounting Clerk, Business Affairs 103 Holladay; Route 4, Raleigh	2155	828-7997
Needham, George F., Asst. Director, Counseling 210 Peele; 728 W. Hargett St.	2424	834-6562
Nelson, Larry A., Asst. Professor, Experimental Statistics 604-G General Laboratory; 2352 Grant Ave.	2534	833-0436
*Nelson, Richard R., Professor, USDA, Plant Pathology 106 Gardner; 810 Faircloth St.	2736	TE4-0609
*Nerden, Joseph T., Professor, Industrial Education 111-B Tompkins; 2201 Dixie Tr.	2241	787-4207
*Neuman, Duane F., Asst. Prof., Agri. Econ. 4-C Patterson; 3117 Glenridge Dr.	2607	828-9738
*Neunzig, Herbert H., Assoc. Prof., Entomology 237 Gardner; 1209 Westmoreland Dr.	2745	787-4382
*Newman, Slater E., Professor, Psychology 222 Tompkins; 1301 Crabapple Ln.	2252	834-5632
*Newton, Cleo A., Electronic Technician, Electrical Engr. 122 Daniels; 1006 Carlton Ave.	2335	828-6867
*Newton, Melvin F., Agri. Res. Superv., Crop Science 114 Williams; Rt. 1, Raleigh	2638	TE4-9971
*Newton, Nancy M., Steno., Horticultural Science 214 Kilgore; Rt. 1, Raleigh	2660	834-9971
Nichols, Barbara A., Secretary, Facilities Planning Division Watauga, West Entrance; 2213 Brewer St.	2121	834-1076
*Nichols, Joan M., Secretary, Civil Engr. 208 Mann; 3511 Andrews Ln.	2331	787-4809
*Nichols, T. E., Jr., Extn. Assoc. Prof., Extn. Economist., Agri. Econ. 3-A Patterson; 3141 Ashel St.	2612	787-0167
*Nichols, William C., Instructor, Architecture 200-E Brooks; 810 Chamberlain St.	2204	VA8-2928
*Nielsen, Lowell W., Professor, Plant Pathology (On leave)		
*Nipper, Ollie M., Receiving Clerk, Animal Science Dairy Records Processing Center, Leazar; E-201 Boylan Apts.	2632	832-7144
*Nirmel, C. N., Instructor, Mechanical Engr. 290 Broughton; 719-C Chamberlain St.	2365	832-6206
†Nixon, Janice B., Veri-Type Oper., Agri. Information 23 Ricks; 3432 Cheyenne Rd.	2791	834-7051
*Noble, Billy W., Agri. Res. Tech., Food Science 132 Polk; 207 Ford Cir., Louisburg	2795	496-5233
*Noble, Jesse T., Res. Analyst, Industrial Extn. Service 1-B IES Building; Rt. 2, Wake Forest	2359	CO6-2569

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Nobles, Daisy D., Steno., Industrial Extn. Service 4-IES Building; Q-302 McKimmon Village	2356	832-1403
*Noblin, Evelyn B., Asst. Cataloger, Catalog 109 Library; 805 Yarmouth Rd.	2841	787-4420
*Noblin, Stuart, Professor, History & Political Science 114 Harrelson; 805 Yarmouth Rd.	2481	787-4420
*Noggle, Glenn R., Professor, Botany & Head, Botany & Bacteriology 145 Gardner; 1920 Smallwood Dr.	2727	828-5144
*Nolstad, Arnold R., Assoc. Prof., Mathematics 205 Harrelson; 1312 Lutz Ave.	2381	834-0680
*Nordan, Elizabeth H., Secretary, Agri. Engr. 100 Agri. Engr.; Rt. 1, Benson	2694, 2695	894-4537
*Norris, Suretha K., Secretary, Agri. Institute 108 Patterson; 1212 Gunnison Pl.	2667	787-2376
*Norton, Captain Albert L., USA, Asst. Prof., Military Sci. 154 Coliseum; 2616 Patrick Rd.	2428, 2429	832-3837
*Norton, Everett L., Dist. Agricultural Agent, Agri. Extn. Service 303 Ricks; 809 Woodburn Rd.	2780	TE3-5509
Norwood, Barbara S., Data Processor, Animal Science Dairy Records Processing Center, Leazar; Rt. 6, Box 254, Raleigh	2632	787-0562
*Nowell, Eloise B., Accounting Clerk, Payroll, Business Affairs 206 Holladay; Box 781, Wendell	2151, 2152	FO5-7105
*Nusbaum, Charles J., William Neal Reynolds Distinguished Professor, Plant Pathology 102 Gardner; 2821 Kilgore Ave.	2736	833-8148
*Nutter, Billy L., Instructor, Physical Education Carmichael Gymnasium; 2256 Rumson Rd.	2487	834-4518
*Nye, Phares S., Instructor, Freshman Engineering Division 277 Broughton; Rt. 4, Cary-Macedonia Rd.	2387	TE3-4988

O

*O'Brien, William L., Instr. in Architecture, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*O'Brien, Zeviee Q., Agri. Res. Asst., Animal Science 345 Polk; 217 Gardner St.	2773	833-7573
*Ogburn, Jimmy R., Part-Time Instructor, Agri. Institute 5008 Brookhaven Dr.	2667	787-3481
†Ohmer, Helen T., Administrative Secretary, Chancellor's Office "A" Holladay; 2307 Lyon St.	2191	833-8872
*Oldham, Diane W., Steno., Animal Science 123-A Polk; 130-B Cox Ave.	2755	828-4974
*Oleson, Kenneth S., Asst. Prof., Industrial Education 111-B Tompkins; 416 Carolyn Ct., Cary	2241	467-1505
*Oliver, George M., Instructor, Chemistry 317 Withers; 413 Walker St., Cary	2524	HO7-1723
*Oliver, Grover C., Jr., Agri. Res. Asst., Crop Science 480-D Williams; Rt. 4, Raleigh	2644	TE3-8324
*Olsen, Bernard M., Professor, Economics 132 Harrelson; 3727 Swift Dr.	2472	TE4-6068
*Olsson, Lynne T., Agri. Res. Asst., Genetics 345 Gardner; Rt. 8, 35-B, Raleigh	2734	834-0031
*O'Neal, James M., Agri. Res. Superv., Horticultural Science 232 Kilgore; 2113 Noble Rd.	2669	TE3-3529
*Orr, Adriana P., Librarian, Textiles 111 Nelson Textile; Philcrest, Leesville Rd., Rt. 6	2562	787-3109

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
Orr, Nita L., Specialist, Frozen Foods, Agri. Extn. 216 Ricks; W-1-B Cameron Court Apts.	2787	834-1558
*Orr, Oliver H., Jr., Asst. Prof., History & Political Science 109 Harrelson; Box 90-C, Leesville Rd., Rt. 6	2481	787-3109
*Osburn, Donald D., Instructor, Agri. Econ. 16 Patterson; Rt. 8, Box 36, Raleigh	2603	834-3703
*Osterman, Linda P., Library Asst., Circulation Library; 120 Cox Ave., Apt. 3	2845	832-0796
Ostrand, Robert L., Sergeant, USAF, Aerospace Studies 145 Coliseum; 2424 Wade Ave.	2417, 2418	828-8093
*Otto, Charlie H., Agri. Res. Asst., Animal Science Rt. 8, Raleigh		833-3741
*Overby, Rosa W., Clerk, N.R.R.C. 505 Oberlin Road, Room 100; 2228 Sheffield Rd.	2866	832-2527
*Overton, E. Glenn, Asst. Director for Registration, Admissions & Registration 2-B Peele, 1802 Fairview Rd.	2432, 2431	TE3-0985
*Owen, Guy, Assoc. Prof., English 13 Winston; 2718 Everette Ave.	2461	833-9913
*Owen, Hubert L., Instructor, Physics 406 A General Laboratory; 1625 Glenwood Ave.	2515	VA8-7114
*Ozisik, M. Necati, Assoc. Prof., Mechanical Engr. 309 Broughton; 4900 Six Forks Rd.	2371	787-2227

P

*Pace, Virgeon A., Jr., Electrical Engineer, Experimental Statistics General Laboratory; 2452 Derby Dr.	2541	833-7089
*Paget, Edwin H., Assoc. Prof., English 212 Winston; 2733 Everette Ave.	2463	832-3495
*Palmour, Hayne, III, Res. Assoc. Prof., Engr. Research 141 Riddick; 2606 Wade Ave.	2351	TE3-8439
*Parasiuk, Maria, Key Punch Oper., Agri. Econ. 212 1911 Building; 1142 Wimbleton Dr.	2617	787-3181
*Pardue, Don C., Extn. Instr., Dairy Husbandry, Animal Science 105A Polk; 914 Ralph Drive, Cary	2771	467-1969
*Pardue, James E., Assoc. Prof., Textiles 142 Nelson Textile; 205 Rose St., Cary	2566	467-1155
Parekh, Ramesh J., Instructor, Mechanical Engr. 290 Broughton; 205 Ashe Ave., Apt. 1	2366	834-2242
*Park, Hubert V., Professor & Administrative Asst., Mathematics 250 Harrelson; 3120 Darien Dr.	2383	TE2-3589
*Park, Joe Y., Asst. Prof., Physics 410C General Laboratory; 5036 Kaplan Dr.	2513	833-1530
Parker, George W., Instructor, Physics 410B General Laboratory; Box 150, Rt. 1, Cary	2513	833-2450
Parker, Gladys P., Nurse, Student Health Service Clark Infirmary; 1600 Brooks Ave.	2410	832-1551
*Parker, Jack W., Extn. Animal Husb. Spec., Animal Science 111 Polk; 2709 Patrick Rd.	2762	832-2434
*Parker, John M., III, Professor-in-Charge, Geological Engr., Mineral Industries 205 Page; 3113 Darien Dr.	2378	TE3-8113
*Parker, Rachel Y., Steno., Industrial Education 111-B Tompkins; P. O. Box 375, Cary	2241	467-9031
*Parker, Ruth W., Secretary, Agri. Econ. 215 Patterson; 3506 Avent Ferry Rd.	2609	828-5196

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Parrish, Clifton F., Extn. Prof. Emeritus, Poultry Science 526 Powell Dr.		828-6304
*Parrish, Leon I., Shops Supt., Physical Plant 1 Park Shop; Rt. 2, Clayton	2181	922-6518
*Parry, Donald C., Agri. Res. Tech., Crop Science 484 Williams; Rt. 1, Box 144, Cary	2644	834-0923
*Parsons, Guy S., Extn. Assoc. Prof., Dairy Hus., Animal Science 103 Polk; 5125 Jeffries Rd.	2771	833-0260
*Partin, Eloise S., Telephone Services Leazar; 4104 Reavis Rd.	2141, 2142, 2143	TE2-0117
Pasour, E. C., Jr., Asst. Prof., Agri. Econ. 210 Patterson; 703-B Daniels St.	2600	833-1668
*Pate, Donald D., Asst. Prof., Poultry Pathology, Poultry Science 108 Scott; 1301 Park Ave., Garner	2624	362-1726
*Pate, Donald Q., Data Processor, N.R.R.C. 505 Oberlin Road, Room 100; 3904 Memory Lane	2866	828-7562
Patrick, Hepsy M., Key Punch Oper., Animal Science Dairy Records Processing Center-Leazar; 2937 Winchester Ct.	2632	828-6316
*Pattee, Harold E., Asst. Prof., Botany, USDA, Botany & Bacteriology 121 Agri. Engr.; 5021 Newcastle Rd.	2681	832-7948
*Patterson, James W., Extn. Assoc. Prof., Animal Husb. Spec., Animal Science 109 Polk; 624 S. Lakeside Dr.	2762	833-1186
*Patton, Carlotta P., Instructor, Mathematics 327 Harrelson, 614 E. Franklin St., Chapel Hill	2389	942-3724
*Patty, Richard R., Asst. Prof., Physics 406 B General Laboratory; 3603 Blueberry Dr.	2515	787-3167
*Paul, Linda K., Clerk, Admissions 107 Peele; 1215 Kent Rd.	2433	833-8714
*Pavagadhi, Lalji J., Instructor, Mechanical Engr. 17 Broughton; K-21 McKimmon Village	2366	828-5649
*Pearce, Howard D., Instructor, English 209 Winston; 407 Brooks Ave.	2463	828-8085
*Pearce, Lawrence W., Agri. Res. Asst., Entomology 231 Gardner; Route 4, Zebulon	2745	
*Pearce, Robert I., Agri. Res. Asst., Soil Science 390 Williams; Rt. 2, Wake Forest	2637	
*Pearsall, Robert J., Asst. Prof. Emeritus, Electrical Engr. Holly Springs, N. C.		
*Pearson, Aline L., Key Punch Oper., Animal Science Dairy Records Processing Center, Leazar; 2209 Mossbank Rd.	2632	833-0855
*Peeler, R. J., Jr., Asst. Prof., Agri. Econ. 14 Patterson; 3513 Leonard St.	2603	834-5594
*Pendergraft, Dwight O., Shop Supt., Physics 7C General Laboratory; 1315 Franklin Rd.	2508	TE4-5854
*Penny, Robert F., Instrument Shop Superv., Engr. Mechanics 325 Riddick & 23 Riddick; Rt. 1, Justice Dr.	2342	834-4102
*Pernell, Willie P., Agri. Res. Asst., Crop Science 452 Williams; Rt. 1, Knightdale	2641	266-2824
*Perry, Aster, Extn. Assoc. Prof., Crop Science 4 0 Williams, 1201 Powell Dr.	2641	833-1046
*Perry, Graham C., Visiting Asst. Prof., Animal Science Animal Disease Laboratory; 1004 Glenwood Ave.	2738	832-6487
*Perry, Jean L., Clerk, Poultry Science Sensory Physiology Lab., Poultry Research Farm, College Rd.; 408½ Kinsey St.	2822	832-3823

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Perry, Jerome J., Asst. Prof., Bacteriology, Botany & Bacteriology 27 Gardner; 1909 Manuel St.	2728	787-0352
*Perry, Paul W., Instructor, Crop Science 453 Williams; 720 Dennis Ave.	2642	832-7536
*Perry, Thomas O., Assoc. Prof., Forest Management 70 Kilgore; 5048 Avent Ferry Rd.	2884	832-1086
*Person, Lee H., Assoc., Prof., Plant Pathology 202 Gardner; 2306 Weymouth Ct.	2752	787-4011
*Petersen, Roger G., Assoc., Prof., Experimental Statistics 513-B General Laboratory; 719 Davidson St.	2541	787-3192
*Peterson, Daniel M., Assoc. Prof., Mathematics 113 Harrelson; 1201 Canterbury Rd.	2381	833-9333
*Peterson, Earl B., Administrative Officer, Agri. & Life Sciences 120 G Patterson; 5517 Holly Springs Rd.	2716	834-6973
*Peterson, Walter J., Dean, Graduate School 104 Peele; 525 Hertford St.	2871, 2872	787-2330
*Peterson, Wilbur C., Assoc. Prof., Electrical Engr. 210 Daniels; 1307 Dogwood Ln.	2335	828-4785
*Petrea, Howard A., Assoc. Prof., Mathematics 205 Harrelson; 20 Furches St.	2381	TE2-8024
*Phelps, Marie M., Agri. Res. Tech., Botany & Bacteriology 210 Gardner; 2834 Mayview Rd.	2728	832-0536
†Philbrick, Corinne S., Reservations & Information, Erdahl-Cloyd Union Erdahl-Cloyd Union; 201 Walnut St., Cary	2455	467-1211
*Phillips, David W., Program Director, Erdahl-Cloyd Union Erdahl-Cloyd Union; 636 S. Lakeside Dr.	2454, 2451	833-1228
*Phillips, L. B., Manager, Print Shop Print Shop; 2811 O'Berry St.	2132	TE2-8437
*Phillips, Lyle L., Professor, Crop Science 482 Williams; 900 Dogwood Lane	2651	833-6232
*Phillips, Robert L., Asst. Prof., Landscape Architecture 212 Brooks; 2744 St. Mary's St.	2203	787-0723
*Pickard, Lucile J., Secretary, Housing Rental Office Leazar; 2216 St. Mary's St.	2440	TE2-3896
*Pickering, Elizabeth H., Secretary, Chemistry 113 Withers; 315 Cutler St.	2546	TE3-3096
*Pierce, W. H., Professor, Agri. Econ. 6-B Patterson; 904 Powell Dr., Garner	2607	362-9493
*Piland, James R., Assoc. Prof., Soil Science 326 Williams; 2406 Stafford Ave.	2636	TE2-9511
*Piland, John E., District Agri. Agent, Agri. Extn. Service 301-A Ricks; 3104 Darien Rd.	2789	TE4-4044
*Pinkerton, Richard C., Assoc. Prof., Chemistry 19 Withers Hall; 3008 Ruffin St.	2538	VA8-8303
*Pinkerton, Robert M., Professor, Mechanical Engr. 121 Broughton; 311 Wilmot Dr.	2368	832-4721
*Pippin, Elizabeth H., Secretary, School of Design 200 Brooks; 2308 Hales Rd.	2205	TE2-8203
*Pizer, Debora R., Programmer, Experimental Statistics 612-A General Laboratory; 1000 Nichols Dr.	2531	833-2092
*Plaster, Captain Larry E., USAF, Asst. Prof., Aerospace Stud. 145 Coliseum; 3424 Cherry Ln.	2417, 2418	833-6193
†Pohl, Emma W., Head Reference Librarian, Reference 122 Library; 2634 Churchill Rd.	2844	828-5283
Poland, George W., Professor & Head, Modern Languages 303 Harrelson; 3929 Arrow Dr.	2475	787-4771

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Pollard, Doris H., Secretary, Agri. Education 121 Tompkins; Box 361, Chatham St., Apex	2235	EL4-6271
*Poole, Dorsey, E., Jr., Equip. Mgr., Athletics Coliseum; 3715 Swift Dr.	2104	833-8890
Poole, Joyce L., Steno., Institute of Biological Sciences 608C General Laboratory; 500 West Park Dr.	2534	TE2-6703
*Poole, Lewis L., Res. Lab. Supvr., Plant Pathology 111 Gardner; 2396 Rock Quarry Rd.	2737	TE4-9522
Poole, Mary E., Head, Documents 118 Library; A-6 Raleigh Apts.	2844	832-8240
*Poole, Nancy R., Key Punch Oper., Animal Science Dairy Records Processing Center, Leazar; 2810 Wayland Dr.	2632	833-1382
*Pope, Daniel T., Res. Prof., Horticultural Science 210 Kilgore; 4813 Glen Forest Dr.	2660	787-1698
Porter, David, Agri. Res. Asst., Plant Pathology 13 Gardner; 107 Shepherd St.	2711	832-6221
*Porter, Jack, Asst. Prof., English 221 Winston; 1514 Ashburton Rd.	2463	834-3013
*Porter, Joseph A., Jr., Professor, Textiles 226 Nelson Textile; 1225 Brooks Ave.	2568	834-3383
*Porterfield, Ira D., Professor & Head, Animal Science 123 Polk; 813 Yarmouth Rd.	2755	787-4524
*Poteat, Laurence E., Instr., Metallurgical Engr., Mineral Industries 106 Page; 5011 Dunbar Rd.	2377	VA8-6566
*Powell, Ben C., Teaching Lab. Asst., Agri. Engr. 154 Agri. Engr.; Rt. 2, Clayton	2662	922-6577
*Powell, Charles, Res. Asst., Poultry Science 105 Scott; 2101 Owens Ln.	2624	828-5120
*Powell, Judy R., Steno., Mathematics 241 Harrelson; Rt. 3, Box 314, Fuquay-Varina	2384	MU7-5447
*Powell, Mary G., Accounting Clerk, Agri. Extn. 120-D Patterson; Rt. 2, Box 113, Clayton	2601	WA2-7541
*Powell, N. T., Assoc. Prof., Plant Pathology 212 Gardner; 114 Merwin Rd.	2751	832-1161
Powledge, Clara P., Steno., Institute of Biol. Sci. 101 Patterson; 2301 Anderson Dr.	2665	832-2232
Prak, Anco L., Instructor, Industrial Engr. 339 Riddick; C-5 Raleigh Apts.	2362	TE4-7483
*Preston, Marjorie C., Secretary, Agri. Extn. 108 Ricks; 2708 Clark Ave.	2813	834-3237
*Preston, Richard J., Jr., Dean, Forestry 160 Kilgore; 3201 Churchill Rd.	2883, 2884	TE2-8864
*Price, Ernest L., Tobacco Inspector, Crop Science 480-C Williams; Rt. 1, Selma	2644	WO5-2588
*Price, Peggy M., Steno., Engineering 232 Riddick; 3304 Pine Grove Rd.	2316	832-5418
Prichard, Virginia M., Instructor, Modern Languages 305 Harrelson; 104 Horne St., Apt. 7	2475	833-5888
*Prince, Harold L., Agri. Res. Superv., Genetics Genetics Nursery; Rt. 4, Raleigh	2757	832-5258
*Prince, Ray, Instructor, Physiology, Poultry Science 227 Scott; Piney Plains Rd.	2623	828-8519
*Prince, Thomas A., Maintenance Mech., Mechanical Engr. 1 Broughton; 5500 Holly Springs Rd.	2374	834-1787
Pritchard, Iola F., Spec. Food Cons. and Marketing, Agri. Extn. 214 Ricks; 1610 Lorraine Rd.	2787	834-6819

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Proctor, Charles H., Assoc. Prof., Experimental Statistics 612-E General Laboratory; 1428 Banbury Rd.	2531	828-2181
*Proctor, E. A., Extn. Assoc. Prof., Extn. Economist, Agri. Econ. 209-A Patterson; Rt. 1, Box 115, Raleigh	2618	828-9835
*Proctor, Jesse A., Trainer & Residence Counselor, Athletics Training Room, Coliseum; Tucker Dormitory	2111	834-3488
*Proctor, Thomas G., Instructor, Mathematics 338 Harrelson; 1534 College Rd.	2389	833-6434
*Proctor, William I., Asst. Univ. Physician, Student Health Service Clark Infirmary; 3221 Landor Rd.	2410	834-8117
Propst, Joyce A., Res. Asst., Soil Science 310 Williams; 1808 Arlington St.	2636	833-3416
*Puffenberger, Martha K., Steno., Soil Science 356 Williams; 431 Stadium Rd., Wake Forest	2637	
*Pugh, C. R., Extn. Assoc. Prof., In Charge Extn. Farm Mgt. & Public Affairs, Agri. Econ. 220-C Patterson; 361 Wilmot Dr.	2723	834-5039
*Purcell, Albert E., Assoc. Prof., USDA, Food Science 310A Polk; 3436 Redbud Ln.	2777	833-8466
*Purser, Anthony F., Visiting Asst. Prof., Animal Science 237 Polk; 225 Woodburn Rd.	2768	

Q

*Quay, Thomas L., Professor, Zoology 242 Gardner; 2608 Barmettler St.	2741	833-9339
*Querry, John W., Assoc. Prof., Mathematics 218 Harrelson; 2631 Windsor Rd.	2385	828-8395
*Quick, Mildred F., Secretary, Housing Rental Office Leazar; 904 Park Ave., Garner	2440	362-9904
*Quinn, Emily H., State Leader, Training Extn. Education, Extn. Personnel Development 109 Ricks; 5604 Winthrop Dr.	2818	787-4863

R

*Raab, Kenneth D., Director, Admissions and Registration 117 Peele; 309 Loop Rd., Garner	2431	EM2-9724
*Rabb, Robert L., Professor, Entomology 229 Gardner; 204 Furches St.	2745	834-8000
*Ragan, Sam T., Instructor, Social Studies 145 Harrelson; 2504 Kenmore Dr.	2479	TE3-3418
*Ragland, Eloise R., Steno., Textiles 107-A Nelson Textile; 2700 Wayland Dr.	2569	832-9539
*Rakes, Allen H., Asst. Prof., Animal Science 242-B Polk; 4204 Galax Dr.	2763	787-2746
*Ramsey, Harold A., Res. Prof., Animal Science 344 Polk; 106 Ralph Dr., Cary	2773	467-9401
*Randall, Glenn O., Prof. Emeritus, Horticultural Science 126 Kilgore; 901 Canterbury Rd.	2683	TE3-9643
*Rankin, William H., Assoc. Prof. Emeritus, Soils 2408 Stafford Ave.		832-8057
*Rasmussen, Barbara S., Typist, General Extension 126 1911 Building; P-124 McKimmon Village	2261, 2262, 2267	TE3-2395
*Rasor, Mollie P., Accounting Clerk, Alumni Affairs Alumni; Rt. 8, Box 24, Raleigh	2860, 2869	834-0078

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Ratliff, Captain John A., USA, Asst. Prof., Military Science 154 Coliseum; 315 Glen Valley Dr.	2428, 2429	787-4772
*Rawlings, John Oren, Assoc. Prof., Experimental Statistics 608B General Laboratory; 626 Stacy St.	2534	VA8-2750
*Rawls, Horace D., Director, Ft. Bragg Division, N.C.S. of U.N.C. 354 Harrelson; 2306 Anderson Dr.	2491	TE2-0616
Ray, Betty Jean, Secretary, Agri. Econ. 205 Patterson; Rt. 1, Raleigh	2600	787-0629
†Raymond, Ethel C., Steno., Extn. Animal Husbandry 119 Polk; 23 Dixie Tr.	2761	832-5677
*Reed, Ann M., Steno., Agri. Extn., 4-H Dept. 208 Ricks; 2414 Avent Ferry Rd.	2802, 2803	TE4-0881
*Reekie, Joy S., Agri. Res. Tech., Food Science 8 Scott; 510 Phelps Ave.	2628	828-6167
*Reese, Clint M., Extn. Instr., Ani. Husb. Extn. Spec., Animal Sci. 109 Polk; 217 Rose St., Cary	2762	467-1193
*Reeves, George G., Instructor, Electrical Engr. 433 Daniels; 3324 Octavia St.		833-9867
*Reid, David W., Instr. & Acting Dir., Computing Center 8-B Nelson Textile; Rt. 1, Box 744, Cary	2510, 2518	467-1719
*Reid, Elbert, Asst. Prof., Agri. Information 313 Ricks; 1516 Banbury Rd.	2806	833-2147
*Reid, Mary E., Data Processor, Animal Science Dairy Records Processing Center, Leazar; 609 Virginia Ave.	2632	832-9905
*Reid, Preston H., Director, Soil Testing Division & Assoc. Prof., Soil Science 230 Williams; 3512 Merwin Rd.	2643, 829-3335	833-3571
*Reid, William W., Extn. Instructor, Horticultural Science Tidewater Research Station, Plymouth; Roper, N. C.	Swan 3-2049	Swan 3-4597
*Reid, Willis A., Professor, Chemistry 106 Withers; 1439 Dixie Tr.	2549	TE2-6016
*Revels, Priscilla B., Steno., Wood Products Ext. 266 Kilgore; 2618 Noble Rd.	2892	TE4-8019
*Rexrode, Lois N., Addressograph Oper., Alumni Affairs 106 Alumni; 1317¼ Dale St.	2869, 2860	
*Rexrode, Thomas L., Airman, USAF, Aerospace Studies 145 Coliseum; 2511 Garner Rd.	2417, 2418	828-2802
*Reynolds, Hal L., Assoc. Editor, Agri. Information 319 Ricks; 833 Ralph Dr., Cary	2806, 2809	467-4614
*Reynolds, Margarette H., Secretary, Entomology 7 Withers; 833 Ralph Dr., Cary	2754	467-4614
*Reynolds, Thomas B., Agri. Res. Asst., Animal Science Animal Disease Lab.; 732 Carolina Pines Ave.	2738, 2739	832-6353
Rheney, Patricia A., Library Asst., Acquisitions 112 Library; 2113 Glenwood Ave.	2841	833-8784
*Rhodes, Max S., Instructor, Physical Education Carmichael Gymnasium; 512 So. Lakeside Dr.	2487	TE4-0489
*Rice, James T., Asst. Prof., Wood Sci. & Tech. 256 Kilgore; 930 Pamlico Dr., Cary	2883	467-1844
Rice, Janet L., Secretary, History & Political Science 103 Harrelson; 406 Yarmouth Rd.	2482	832-2791
*Rice, John C., Director, N. C. Crop Improvement 193 Williams; 109 N. Lord Ashley Rd.	2851	832-0937
*Rice, Pansy R., Steno., USDA, Food Science 225 Polk; 310 Furches St.	2868	TE3-4498
*Rice, T. R., Adjunct Prof., USDI, Zoology Radiobiological Labs, Beaufort	Beaufort	728-4597

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Rich, Nancy B., Instructor, English 217-19 Winston; 3411 Bradley Pl.	2463	833-7327
*Rich, Raymond R., Extn. Asst. Prof., Dairy Husb., Animal Science 102 Polk; Burgaw, N. C.	2771	259-2967
Richardson, Frances M., Res. Assoc. Prof., Engr. Research 206 Riddick; P-5 Raleigh Apts.	2326	TE4-4821
*Richardson, Helen A., Accounting Clerk, Agri. Engr. 100 Agri. Engr.; 704 Powell Dr.	2695	TE3-8013
*Richardson, LeRoy P., Baptist Chaplain, Student Affairs Baptist Student Union, Hillsboro St.; 308 Hillcrest Rd.	834-1875	834-5554
†Richardson, Miriam T., Secretary, Animal Science 102 Polk; 3414 Bellevue Rd.	2771	828-2974
*Riggle, Katherine S., In Charge, Home Management, Agri. Extn. 207 Ricks; 1322 Rand Dr.	2784	828-2833
*Rigney, Jackson A., Director, Agricultural Mission to Peru 1-G Patterson; 2607 Wade Ave.	2671, 2672	832-5084
Ringgold, Donna G., Steno., Soil Science 428 Williams; 4407 Laurel Hills Rd.	2645	787-1238
*Rinne, Allan W., Res. Analyst, Industrial Extn. Service 1-B IES Building; 4710½ Vanderbilt Ave.	2359	
*Ritchie, Ray M., Jr., Extn. Assoc. Prof., Agri. Engr. 209 Agri. Engr.; 1332 Walnut Tr.	2678	833-7080
Ritter, Erwin F., Instructor, Modern Languages 308 Harrelson; 34 Shepherd St.	2475	832-0951
*Roberson, Keith, Disciples of Christ Chaplain, Student Affairs 718 Hillsboro St.; 1324 Brooks Ave.	832-7112	833-6830
*Roberts, Carlton A., Res. Asst., Poultry Science Poultry Research Farm, College Rd.; Macedonia Rd., Cary	2729	834-6613
*Roberts, Jerry A., Instructor, Mathematics 317 Harrelson; 1839 Ronald Rd., Rt. 7, Box 113F	2389	828-5789
*Roberts, Louise F., Steno., Experimental Statistics 513 General Laboratory; O-11 McKimmon Village	2541	832-7369
*Roberts, Mabel H., Nurse, Student Health Affairs Clark Infirmary; 120 E. Whitaker Mill Rd.	2410	VA8-2083
*Roberts, Madeline H., Typist, Food Science 126 Polk; 940 Jones Ave.	2796	TE3-3219
*Roberts, William M., Professor & Head, Food Science 124 Polk; 1305 Lutz Ave.	2796	TE3-9368
Robertson, Nita C., Steno., Soil Science 328 Williams; 22½ Dixie Tr.	2636	833-3329
*Robertson, Robert L., Extn. Assoc. Prof., Entomology 141 Gardner; 831-C Daniels St.	2703	828-7531
*Robertson, Zelda, Accounting Clerk, Business Affairs 3 Holladay; 2117 St. Mary's St.	2139	TE3-7906
Robinson, Allan R., Photographer, Agri. Information 3 Ricks; 717 Chamberlain St.	2862	834-7908
*Robinson, Cowin C., Professor, Chemistry 301 Withers; 1407 Lutz Ave.	2524	TE3-9925
*Robinson, Harold F., Dir., Inst. Bio. Sci., Asst. Dir. Res., Agri. Exp. Station, & Prof., Genetics 101 Patterson; 2126 Buckingham Rd.	2665	828-9809
†Robinson, Martha G., Library Asst., Catalog 109 Library; P-7 Raleigh Apts.	2841	834-8072
*Robinson, Mendel L., Jr., Instructor, Textiles B-51 Nelson Textile; Apt. W-3 Country Club Homes	2558	833-2216
*Robinson, Captain R. A., USAF, Asst. Prof., Aerospace Studies 145 Coliseum; 732 Carlisle St.	2417, 2418	832-2897

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Robison, Odis W., Asst. Prof., Animal Breeding, Animal Science 226 Polk; 632 S. Lakeside Dr.	2769	832-2572
Rochelle, Charles, Agri. Res. Asst., Food Science Basement Kilgore; Rt. 6, Box 208, Raleigh	2691, 2692	
*Rock, Frances S., Steno.-Clerk, Agri. Information 318 Ricks Hall; 2113 Reaves Dr.	2805, 2809	833-3700
Rodden, Shirley R., Key Punch Oper., Computing Center 11-G Nelson Textile; 2811 Wayland Dr.	2518	VA8-9511
*Rodriquez, Maria Del Carmen, Secretary, Modern Languages 304 Harrelson; 2723 Dorchester Ct.	2475	832-1784
Rogers, Charles H., Asst. Prof., Agri. Education 123 Tompkins; 829-C Daniels St.	2234	832-4807
*Rogers, H. B., Public Info. Officer, Information Services 202 Holladay; 225 Forest Rd.	2874, 2875	
*Rogers, Lyle B., Director, Counseling 205 Peele; 720 Beaver Dam Rd.	2422	TE3-9109
*Rogers, Sarah S., Typist, Acquisitions 112 Library; 608 Austin Ave., Cary	2841	467-1559
†Rood, Hazel B., Res. Tech., Plant Pathology 31 Gardner; 114 Waldo St., Cary	2736	HO7-1925
*Rose, Carolyn A., Typist, Crop Science 102-A Williams; 916 Aukland St.	2640	TE4-2309
Rose, Edith M., Secretary, Forestry 162 Kilgore; B-1B Cameron Court Apts.	2883, 2884, 2885	833-8849
*Rose, Georgia L., Key Punch Oper., Animal Science Dairy Records Processing Center, Leazar; 415 Ranch Farm Rd.	2632	834-3178
*Rosendahl, Annie L., Accounting Clerk, Business Affairs 103 Holladay; 3612 Cranston Rd.	2155	832-5181
*Roseveare, Sally S., Typist, Genetics 353 Gardner; 1216 Franklin Rd.	2731	833-3594
*Ross, John P., Assoc. Prof., USDA, Plant Pathology 209 Gardner; 225 Buck Jones Rd.	2751	TE2-8463
*Rouse, Ann P., Steno., Phys. Sciences & Applied Math. 406 General Laboratory; Rt. 7, c/o Powell's Esso Sta., Raleigh	2515	
*Rousselle, Robert C., Sergeant, USAF, Aerospace Studies 145 Coliseum; 812 Greenwich St.	2417, 2418	828-4795
*Rowland, Macon R., Asst. Director, Physical Plant 102 Morris; 634 Stacy St.	2181	832-3475
*Rowland, W. Earl, Accounting Clerk, Physical Plant 111 Morris; 3312 Pinecrest Dr.	2181	833-1473
*Royal, John C., Dairy Hand, Animal Breeding, Animal Science Dairy Farm; Four Oaks	2674	
*Rudisill, Carl S., Instructor, Mechanical Engr. 17 Broughton; 315 Wilmot Dr.	2366	834-8354
*Rudy, Margaret B., Secretary, Physical Education Carmichael Gymnasium; 2823 Barmettler St.	2486, 2487	TE2-4890
Ruffin, Helen L., Admin. Secretary, Experimental Statistics 103-A General Laboratory; 705 N. East St.	2528	832-5355
*Ruffner, Katharine T., Secretary, Agri. Engr. 120 Agri. Engr.; 2612 Churchill Rd.	2681, 2682	TE2-6039
*Ruggles, Edward W., Director, General Extension 118 1911 Building; 2411 Everett Ave.	2261, 2262, 2267	832-1812
Rulfs, Donald J., Assoc. Prof., English 123 Winston; D-3 Grosvenor Garden Apts.	2464	832-5868
*Runkle, Judith C., Steno., Admissions 105 Peele; I-12 McKimmon Village	2433	

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Russell, Alex, Instrument Maker, Engr. Research 10 Riddick; 703 Powell Dr.	2348	TE3-0906
*Russell, Eleanore R., Secretary, Extn., Horticultural Science 227 Kilgore; 1310 Crabapple Ln.	2686, 2687	TE4-8629
*Rust, Paul J., Assoc. Professor, Psychology 221 Tompkins; 2500 Poole Rd.	2253	834-1696
*Rutherford, Henry A., Head, Dept. of Textile Chem. & Professor, Textiles 115 David Clark Labs.; Box 5751, State College Station	2553	787-4013
*Rutherford, Norma, Administrative Secretary; Agri. Admin. 115 Patterson; Box 5751, State College Station, Six Forks Rd.	2613	787-4013
*Rutledge, Lynda H., Steno., Admissions and Registration 7 Peele; 633-B Daniels St.	2435	834-0867

S

*Sagan, Hans, Professor, Mathematics 339 Harrelson; 5004 Glen Forest Dr.	2389	787-2837
*Saieed, Thomas A., Departmental Services Supt., Physical Plant 2 Park Shop; 1007 Greenwich St.	2181	828-8543
*Sampson, Carol H., Textile Lab. Tech., Textiles B-50 Nelson Textile; Q 223 McKimmon Village	2558	
Samuels, Martin L., Adjunct Asst., Mineral Industries 106 Page; Apt. B, 854 Tryon St.	2377	
*Sanderlin, R. Reed, Instructor, English 17 Winston; 2327 McMullan Cir.	2461	828-6592
Sanders, David G., Res. Asst., Entomology 7 Withers; 537½ East Martin St.	2754	833-1523
*Sanford, G. S., Instructor, Agri. Econ. 206 1911 Building; 203½ Brooks Ave.	2617	833-2702
*Santolucito, John A., Assoc. Prof., Zoology 355 Gardner; 3303 Leonard St.	2741	833-7896
*Sargent, Frank D., Extn. Instructor Dairy Husb., Animal Science 105-B Polk; Raleigh Rd., Wendell	2771	365-7395
*Sasser, Carmen B., Secretary, Agri. Extn. 114 Ricks; 321 Meredith St.	2814	834-6879
*Sasser, Joseph N., Professor, Plant Pathology 107 Gardner; 628 Grove Ave.	2736	TE3-2489
*Sato, Ichiro, Res. Assoc., Botany & Bacteriology 257 Gardner; 1213½ Dixie Tr.	2725	832-3258
*Satterfield, G. Howard, Professor Emeritus, Chemistry 321 Withers; 407 West Park Dr.	2545	TE2-2963
*Satterwhite, James B., Engr. Tech. USDA, Agri. Engr. 126 Agri. Engr.; 2303 Lyon St.	2682	828-5364
*Saunders, Eugene M., Agri. Res. Asst., Crop Science 290 Williams; 2701 Avent Ferry Rd.	2647	833-9111
*Savage, Robert G., Instructor, Mathematics 211 Harrelson; Rt. 1, Greenwood Acres, Vickie Dr., Cary	2381	467-1502
*Saxe, Raymond F., Professor, Nuclear Engr. 236 Riddick; 407 N. Person St.	2304	828-4549
*Saylor, LeRoy C., Asst. Prof., Genetics & Forestry 344 Gardner; 3509 Merwin Rd.	2734	828-5792
*Saylor, Marilyn J., Secretary, Agri. Econ. 220 Patterson; 3509 Merwin Rd.	2610	828-5792
*Scarborough, C. Cayce, Professor & Head, Agri. Education 123 Tompkins; 2604 Barmettler St.	2234	834-4957

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Schaaf, Herman E., Sergeant, USA, Military Science 154 Coliseum; 245 Buck Jones Rd.	2428, 2429	834-6500
Schaible, Robert H., Asst. Prof., Genetics 343-G Gardner; 1407 Brooks Ave.	2704	828-3594
*Schaub, I. O., Dean and Director, Extension, Emeritus 1011 Schaub Dr.		832-8610
*Schelske, C. L., Adjunct Asst. Prof., USDI, Zoology Radiobiological Labs., Bureau Commercial Fisheries, Beaufort	Beaufort 728-4597	
*Schmidt, Robert, Prof. Emeritus, Horticultural Science 124 Kilgore; 516 Gardner St.	2683	TE2-4235
*Schöbel, Joachim-Dietrich, Res. Assoc. Prof., Engr. Research 133 Riddick; 1924 Smallwood Dr.	2348, 2351	834-9544
*Schoenborn, Edward M., Head, Chemical Engr. 113 Riddick; 3114 Sussex Rd.	2324	787-4044
*Schostag, Thea W., Agri. Res. Tech., Botany & Bacteriology 227 Gardner; 1204 Gorman St.	2726	828-4215
Schrimper, R. A., Instructor, Agri. Econ. 203-A Patterson; 3700 Dade St.	2605	787-2862
*Schultz, Wilfred M., Res. Asst. Prof., Genetics 112 Williams; 4121 Yadkin Dr.	2638	787-1687
*Scofield, Herbert T., Professor in Botany, Agri. Mission to Peru 1 Patterson, N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
Scott, Donald J., Accounting Clerk, General Extension 120 1911 Building; 1907 Cameron St.	2261, 2262	828-5545
*Scott, Garland E., Res. Asst., Engr. Research 2 Riddick Annex; 402 Carolina Ave.	2347	833-5058
*Scott, John E., Res. Asst., Horticultural Science Horticultural Greenhouse; Box 42, Method	2685	828-6441
*Seago, Pat H., Accounting Clerk, Genetics 360 Gardner; Rt. 6, Box 359, Raleigh	2731	787-1397
*Seagraves, J. A., Assoc. Prof., Agri. Econ. 203-B Patterson; 5108 W. Lakeside Dr.	2605	832-9923
*Seagraves, Wayland P., Asst. Prof. & Undergraduate Administrator, Electrical Engr. 322-A Daniels; 830 Daniels St.	2338	832-8357
*Sears, Woodrow H., Jr., Asst. Editor, Agri. Information 120 Ricks; 2814 O'Berry St.	2804	832-9704
*Seegers, Louis W., Professor, History & Political Science 112 Harrelson; 2701 Mayview Rd.	2481	832-6238
*Seely, J. Frank, Assoc. Prof., Chemical Engr. 216 Riddick; 300 Brooks Ave.	2326	832-3096
*Selman, Frank L., Instructor, Crop Science 453 Williams; 2241 Noble Rd.	2642	TE2-8673
*Seltmann, Heinz, Asst. Prof., Botany, USDA, Botany & Bacteriology 422-A Williams; 1105 Dogwood Ln.	2642	833-2139
*Senger, Marvin E., Extn. Prof., In Charge, Dairy Husbandry, Animal Science 101 Polk; 1501 Franklin Rd.	2771	832-2457
*Senter, Maxine R., Steno., Botany & Bacteriology 146 Gardner; 4401 Boxwood Rd.	2727	787-0353
Sessoms Sandra L., Agri. Res. Tech., Botany & Bact. 121 Agri. Engr.; 2404 Avent Ferry Rd.	2681	834-3813
*Setzer, Emily E., Steno., Horticultural Science 118 Kilgore; 2906 Everett Ave.	2684	TE4-2013
*Severt, Basil L., Agri. Res. Asst., Animal Breeding, Animal Science College Bull Barn; Rt. 1, Cary	2688	833-4239

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Sexton, Dolores S., Secretary, Agri. Information 117 Ricks; 5325 E. Lakeside Dr.	2807, 2800	834-4900
*Shafer, Thomas D., Sergeant, USA, Military Science 154 Coliseum; 3924 Welmont Dr., Fayetteville	2428, 2429	
*Shahdan, Peter, Asst. Prof., Mathematics 336 Harrelson; 624 Grove Ave.	2389	TE2-1061
*Shain, Roberta S., Instructor, Modern Languages 312 Harrelson; 2710½ Everett Ave.	2475	833-8576
*Shankle, Arthur T., Instructor, Electrical Engr. 302 Daniels; 4229 Rowan St.		787-1332
*Shannon, Henry A., Asst. Prof., Math. & Science Ed. 104 Tompkins; 1102 Poplar St., Garner	2239	EM2-5591
*Shaw, Graye J., Instructor, Chemistry 110 Withers; P. O. Box 12081	2545	467-1336
*Shaw, Luther, Assoc. Prof., USDA, Crop Science Box 30, Waynesville	Waynesville 456-3943	456-3665
Shawcroft, Brian, Assoc. Prof., Architecture 314 Brooks; 101½ Oberlin Rd.	2203	VA8-6396
*Shea, W. Michael, Asst. Prof., Physical Education Carmichael Gymnasium; 2705 Royster Rd.	2487	TE3-7689
*Shearin, Doris W., Typist, Admissions & Registration 12-B Peele; 110 Dowell Dr., Cary	2436	467-1535
Shearin, Marjorie L., Specialist, Creative Crafts, Agri. Extn. 210 Ricks; 3413 Rosebud Ln.	2785	828-6079
*Shearin, Sue S., Steno., Electrical Engr. 322 Daniels; 1213 Pearce St.	2338	833-7971
*Sheehan, Dorothy O., Instructor, Mathematics 327 Harrelson; 18 Maiden Lane	2389	832-6772
*Sheehan, George H., Production, ETV Educational Television Studio, Western Blvd.; 1905 French Dr.	2853	787-0750
*Sheehan, Ruth G., Asst. Editor, Agri. Information 319 Ricks; 1905 French Dr.	2806, 2809	787-0750
*Sheldon, Major R. J., USAF, Asst. Prof., Aerospace Studies 145 Coliseum; 1201 Kimberely Dr.	2417, 2419	787-1745
*Shelley, A. Bernard R., Assoc. Prof., English 119 Winston; 1206 Canterbury Rd.	2464	832-6235
*Shelton, James E., Asst. Prof., Soil Science 542 Broadway, Hendersonville	Hendersonville 692-1630	692-4472
Shelton, Sondra R., Accounting Clerk, Business Affairs 7 Holladay; 705-C Daniels St.	2130	834-4862
*Sherwood, Robert T., Assoc. Prof., USDA, Plant Pathology 201 Gardner; 5019 Kaplan Dr.	2752	828-9441
*Shieh, Paulinus S., Instructor, Physics 406-F General Laboratory; 108 Pogue St.	2515	832-9782
*Shinn, William E., Head, Knitting Tech. & Professor, Textiles 110 Nelson Textile; 2709 Bedford Ave.	2573	833-0713
*Shipley, Mildred K., Clerk, N. C. Crop Improvement 193 Williams; 811 W. Johnston St.	2851	832-6198
†Shirley, Alice A., Secretary, Student Activities 202 Peele; 2515 Clark Ave.	2443	TE4-1851
*Shoffner, Robert W., Director of Foundations & Development 12 Holladay; 428 Bickett Rd.	2846	787-2882
Shogren, Vernon F., Asst. Prof., Architecture 213 Brooks; 3524 Avent Ferry Rd.	2203	TE3-4140
*Shore, Thomas C., Asst. Prof., Industrial Education 111-B Tompkins; 3417 Fairhill Dr.	2241	787-0275

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Shriver, Donald W., Jr., Presbyterian Chaplain, Student Affairs 27 Horne St.; 18 Henderson St.	828-5468	828-5292
†Shuford, May R., Library Asst., Reserve Room 210 Library; 810 W. Johnson St.	2845	TE2-5497
*Shulenberger, C. B., Prof. Emeritus, Economics 137 Harrelson; 2501 Stafford Ave.	2472	TE2-7165
*Shuler, John B., Asst. Prof., Civil Engr. 210 Mann; 714 Faircloth St.	2332	832-7684
*Siler, Mary W., Secretary, Agri. Econ. 209 Patterson; Poole Rd., Hodges Trailer Park	2618	828-7875
*Simmons, R. L., Assoc. Prof., Agri. Econ. 201-G Patterson; 1421 Dellwood Dr.	359	833-6129
*Simonsen, Sofus E., Instructor, Modern Languages 309 Harrelson; 305 Gary St.	2475	834-8992
*Simpson, William H., Assistant to Dean of Faculty A Holladay; 3013 Mayview Rd.	2192, 2193	TE2-7394
*Singleton, John A., Agri. Res. Tech., Food Science 134 Polk; 3504 Mercury Cir.	2795	833-2084
*Sinha, Surendre P., Res. Assoc., Experimental Statistics 608-A General Laboratory; 801 W. Leonard St.	2534	834-0655
Sisler, Edward C., Assoc. Prof., Chemistry & Crop Science 406 Williams; 2102-A Smallwood Dr.	2635	832-3354
*Skeele, Nora S., Steno., Entomology 329 Gardner; 726 Powell Dr.	2748	362-1752
*Skerrett, Carmen R., Bilingual Secretary, Soil Science 101 Williams; 1105 Belfast Dr.	2630	834-4913
*Skroch, Walter A., Extn. Asst. Prof., Horticultural Science 227 Kilgore; 3600 Blueberry Dr.	2686, 2687	787-3814
*Sledge, Diane D., Secretary, Animal Science Dairy Records Center, Leazar; Rt. 2, Wendell	2632	365-7993
*Sledge, John M., Agri. Res. Asst., Plant Pathology 4 Gardner; Rt. 2, Wendell	2721	FO5-7993
*Sloan, Benjamin J., Instructor, Electrical Engr. 208 Daniels; 828 Brigham Rd.	2335	833-6939
*Sloan, Frederick S., State Leader, Training, Extn. Personnel Development 109 Ricks; 1407 Canterbury Rd.	2818	833-6310
*Small, Howard G., Extn. Asst. Prof., Crop Science 130 Williams; 3307 Briarcliff Rd.	2639	833-9920
*Smallwood, Charles, Jr., Professor, Civil Engr. 416 Mann; 305 Transylvania Ave.	2333	787-2225
*Smaltz, Elizabeth A., Instructor, Physical Education Carmichael Gymnasium; 2121 Buckingham Rd.	2487	833-0727
*Smaltz, William R., Asst. Football Coach, Athletics 115 Coliseum; 2121 Buckingham Rd.	2101	833-0727
*Smart, Virginia W., Agri. Res. Superv., Animal Science 301 Polk; 311 Meredith St.	2773	833-4135
*Smart, William W. G., Jr., Assoc. Prof., Experimental Statistics, Animal Science 513-G General Laboratory, 325 Polk; 311 Meredith St.	2541, 2773	833-4135
†Smeltzer, Olena, Secretary, Animal Science 104 Polk; 3109 Devonshire Dr.	2771	834-0582
*Smetana, Frederick O., Assoc. Prof., Mechanical Engr. 322 Broughton; 5425 Parkwood Dr.	2373	787-2743
*Smiley, Thomas B., Instructor, Electrical Engr. 208 Daniels; 2612 Vanderbilt Ave.	2335	828-6510

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Smith, Ben W., Professor, Genetics 342 Gardner; 701 Runnymede Rd.	2704	832-9962
*Smith, Betty S., Secretary, Liberal Arts 161 Harrelson; 317½ Dixie Tr.	2467, 2468	VA8-9490
*Smith, Clyde F., Professor, Entomology 331 Gardner; 2716 Rosedale St.	2749	832-3396
*Smith, Dick W., District 4-H Club Agent, Agri. Extn. 204 Ricks; 920 Warren St., Cary	2802, 2803	HO7-9997
*Smith, Doris D., Steno., Agron. Extn., Crop Science 250 Williams; 3217 New Hope Rd.	2653	TE2-2229
*Smith, Edward H., Professor & Head, Entomology 143 Gardner; 220 Ellwood Dr.	2746, 2747	787-4304
*Smith, Elizabeth A., Accounting Clerk, Business Affairs 4 Holladay; Rt. 2, Raleigh	2149	362-9977
*Smith, Ewald, Agri. Res. Tech., Entomology 125 Gardner; 925 Weston St.	2620	
*Smith, Faison, Res. Superv., Entomology 234 Gardner; 1116 Parker St.	2745	832-7133
*Smith, Farmer S., Asst. Prof., Industrial Education 111-B Tompkins; 5012 Brookhaven Dr.	2241	787-1716
*Smith, Frank H., Res. Prof., Animal Science 324 Polk; 2506 Stafford Ave.	2773	832-6798
*Smith, George W., Professor, Forestry & Assoc. Director, Agri. Extn. Service, Agri. Extn. 106 Ricks; 2213 Dixie Tr. Ext.	2812	787-4629
*Smith, J. McCree, Director, Physical Plant 101 Morris; Rt. 8, Box 98, Raleigh	2181	832-8466
*Smith, Judith G., Steno., Poultry Science 208 Scott; Q-201 McKimmon Village	2623	828-4801
*Smith, Martha (Bee) M., Secretary, Agri. & Life Sciences 111 Patterson; Rt. 1, Box 144, Cary	2615	834-7638
*Smith, Mary Ann L., Textile Lab. Tech., Textiles B-48 Nelson Textile; Rt. 3, Wake Forest	2565	EX5-3082
*Smith, Oliver J., Res. Asst., Poultry Science Poultry Research Farm, College Rd.; 324 Summit Ave.	2729	833-6789
*Smith, P. G., Adjunct Prof., Electrical Engr. 5716 Winthrop Dr.		787-3373
*Smith, Percy G., Dairy Plant Operator, Food Science Basement Polk; Rt. 2, Clayton	2700	
*Smith, Ray, Assoc. Director, Placement Center 106 Robertson Lab.; 312 Ortega Rd., Farrior Hills	2889	787-4394
*Smith, William E., Asst. Prof., Textiles 120 Nelson Textile; Box 126, Varina	2572	MU7-2729
*Smith, William E., Professor, Physical Education Carmichael Gymnasium; 2611 Kittrell Dr.	2487	TE3-8066
*Snavely, Joseph C., Jr., Data Processing Mgr., Computing Center 11-B Nelson Textile; 4201 Wedgewood Dr.	2510, 2518	832-3525
*Sneed, Ronald E., Extn. Instructor, Agri. Engr. 201-A Agri. Engr.; 2300 McMullan Cir.	2677	834-2465
*Snell, Oliver S., Maintenance Mech., Mechanical Engr. 20 Broughton; 2806 Crestline Ave.	2366	832-5366
*Snyder, Rufus N., Prof. Emeritus, Physics 1609 Gorman St.		TE2-4130
*Sonner, William H., Asst. Prof., Physical Education Carmichael Gymnasium; 1043 Pineview Dr.	2487	VA8-2049

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Soots, Robert F., Wildlife Biologist, Zoology 244 Gardner; Rt. 4, Box 67, Campbell Rd.	2741	834-0002
*Soots, Sharon S., Secretary, Counseling 205 Peele; Rt. 4, Box 67, Campbell Rd.	2422	834-0002
*Sopher, Sharron W., Library Asst., Acquisitions 112 Library; 2324 Grant Ave.	2841	828-3195
*Sorrell, Victor G., Baseball Coach, Athletics 122 Coliseum; 1625 St. Mary's St.	2104	828-5578
*Sowell, Ann B., Typist, Central Stores 108 Morris; 1605 Pineview St.	2197, 2198	828-8918
*Sox, Harriet N., Res. Asst., Horticultural Science 201 Kilgore; 409 S. West St., Cary	2660	HO7-2083
Sox, Jason L., Instructor, Mathematics 219 Harrelson; 409 South West St., Cary	2385	HO7-2083
*Spain, James M., Assoc. Prof., Soil Science 408 Williams; 209 Merwin Rd.	2645	834-0014
*Sparks, Marvin R., Wood Utilization Specialist, Industrial Extn. Service 1-B IES Building; 3620 Cove Ave.	2359	833-5382
*Speck, Marvin L., Professor, Food Science 128G Polk; 3204 Churchill Rd.	2794	TE4-1675
*Speece, Herbert E., Professor, Math. & Science Ed. 102 Tompkins; 3408 Wade Ave.	2239	TE4-1849
*Speidel, George S., Jr., Instructor, Mathematics 217 Harrelson; 1528 Carr St.	2385	833-1282
Spencer, Clara F., Agri. Res. Tech., Soil Science 383 Williams; 1040 Nichols Dr.	2649	828-7163
*Spencer, J. A., Instructor, USDA, Plant Pathology 206 Gardner; 5234 Vann St.	2752	834-7924
*Spivey, Anne A., Steno., Electrical Engr. 320 Daniels; Rt. 4, Raleigh	2336	834-3174
*Splinter, William E., Professor, Agri. Engr. 112 Agri. Engr., 31 Shepherd St.	2696	828-5145
*Spruill, David G., Extn. Asst. Prof., Animal Husb. Spec., Animal Science 118 Polk; 215 Gordon St., Cary	2761	467-9212
*Stabile, Eugene L., Supervisor, Cafeteria, A.R.A. Slater Harris Cafeteria; 1650 Van Dyke Ave.	2857, 2858	
Stack, Edward M., Professor, Modern Languages 310 Harrelson; 3609-C Anclote Pl.	2475	787-2835
*Stacy, Ralph W., Professor, Biomathematics, Experimental Statistics & Zoology 518-D General Laboratory; Rt. 1, Wake Forest	2541	787-1772
*Stadelmaier, Hans H., Res. Professor, Engr. Research 131 Riddick; 906 Brooks Ave.	2348	
Stadtherr, Richard J., Extn. Asst. Prof., Horticultural Science 234 Kilgore; 2419 Mayview Rd.	2686	834-5810
*Stafford, Donald B., Instructor, Civil Engr. 213 Mann; 4428 Memorial Dr.	2332	787-1382
†Stahel, Edward P., Asst. Prof., Chemical Engr. 308 Riddick; 328 Meredith St.	2327	832-0922
*Stahl, Roberta F., Agri. Res. Asst., Entomology 331 Gardner; 313 Williams St., Cary	2748	467-4531
*Stainback, Raymond F., Assoc. Prof., Physics 408 General Laboratory; 2525 Grant Ave.	2514	TE4-6022
*Stallings, David W., Instructor, Mechanical Engr. 290 Broughton; 8-25 McKimmon Village	2366	828-6107

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Stallings, Edna S., Res. Asst., Soil Science 306 Williams; H-25 McKimmon Village	2636	828-6107
*Stallings, Ernest M., Extn. Instructor, Agri. Engr. 201 Agri. Engr.; 4306 Driftwood Dr.	2678	834-2659
*Stamm, Alfred J., Professor, Wood Sci. & Tech. 10 Robertson Lab.; 3212 Wayne St.	2889	787-1555
*Stamp, Reba H., Duplicating Machine Oper., Agri. Econ. 207 Patterson; 2128 Mayview Rd.	2600	833-0420
*Stancil, Arthur L., Res. Asst., Poultry Science Poultry Research Farm, College Rd.; Rt. 4, Raleigh	2729	833-7813
*Stanley, Loretta J., Key Punch Oper., Admissions & Registration 4 Peele; 2620 Kilgore Ave.	2432	
*Stanley, Nancy W., Agri. Res. Tech., Animal Science 322 Polk; 115 Georgetown Rd.	2773	832-7844
*Stansel, David B., Asst. Director, General Extension 123 1911 Building; 1004 Dogwood Ln.	2261, 2262, 2267	833-9720
*Stanton, William M., Forest Management Extn. Specialist, Extension Forestry 55 Kilgore; 1106 Park Ave., Garner	2891	362-1117
*Starnes, M. Eugene, Asst. Director, General Extension 121 1911 Building; 2321 Dover Farm Rd.	2261	832-4238
*Stauffer, William M., Post-doctoral Fellow, Experimental Statistics 518-C General Laboratory; Rt. 8, Box 61, Raleigh	2541	834-9638
*Steagall, Patricia C., Steno., Textiles 120 Nelson Textile; 1508 Frank St.	2572	833-9587
*Steed, Constance B., Steno., Industrial Extn. Service 1-A IES Building; 4413 Laurel Hills Rd.	2359	787-0472
*Steel, Robert G. D., Professor, Experimental Statistics 604-B General Laboratory; 2108 Dixie Tr.	2534	787-4685
*Stephanopoulous, Elis K., Eastern Orthodox Chaplain, Student Affairs 211 S. Person St.; 2301 McMullan Cir.	833-1755	834-9609
*Stephens, Elsie Mae, Secretary, Dean of Faculty A Holladay; 109 Creech Rd., Garner	2192, 2193	EM2-5051
*Stephens, Stanley G., William Neal Reynolds Professor, Genetics 340 Gardner; 3219 Darien Dr.	2732	787-4756
*Stephenson, Katherine S., Secretary, Agri. & Life Sciences 109 Patterson; 409 Winterlochen Rd.	2719	832-4169
Sterling, Ann L. P., Secretary, Psychology 201 Tompkins; Rt. 2, Wendell	2251, 2252	266-2502
*Stevenson, Lois M., Agri. Res. Tech., Soil Sciences 306 Williams; 215 Taylor St.	2636	TE3-3101
*Stevenson, William D., Professor & Graduate Administrator, Electrical Engr. 327 Daniels; 2706 White Oak Rd.	2339	834-5956
*Stewart, Hamilton A., Asst. Dir. of Research, Agri. & Life Sciences 109 Patterson; 829 Woodburn Rd.	2719	833-3953
*Stewart, James J., Jr., Dean, Student Affairs 101 Holladay; 2313 Anderson Dr.	2446	TE3-3110
Stewart, Margie M., Steno., Industrial Arts 106 Tompkins; 2424 Mayview Rd.	2237	834-0416
*Stilley, Thelma K., Textile Res. Tech., Textiles B-21 Nelson Textile; 1116 Fuller St.	2565	834-1185
*Stilwill, Charles F., Asst. Theater Director, Erdahl-Cloyd Union Frank Thompson Theater; 2110 Mayview Rd.	2405	833-6970
*Stines, Bill J., Asst. Statistician, Experimental Statistics 612-D General Laboratory; Rt. 4, Piney Plains Road	2531	834-8771

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Stinson, Edward H., Instructor, Freshman Engineering Division 275 Broughton; 108 Horne St.	2387	TE4-3834
*Stipes, Roland J., Res. Assoc., Plant Pathology 29-A Gardner; Box 5171, Raleigh	2722	TE2-7581 Ext. 354
*Stober, William J., Asst. Prof., Economics 127 Harrelson; 3803 Avent Ferry Rd.	2472	TE3-4000
Stoker, Susan F., Secretary, Extn., Agri. Engr. 203 Agri. Engr.; 915 W. Johnson St.	2675, 2677, 2678	832-5298
*Stone, Connie A., Apprentice Instrument Maker, Engr. Research 10 Riddick; 2326 Bernard St.	2348	834-4288
†Stone, Hilda U., Stock Clerk, Chemistry 318 Withers; Apt. B-3, 3109 Hillsboro St.	2547	TE2-3443
Stone, Margaret J., Instructor, Mathematics 329 Harrelson; 1869 W. Smallwood Dr.	2389	828-8173
*Stone, Olive A., Telephone Receptionist, Physical Plant 115 Morris; 222 Hillsboro Rd., Cary	2181	467-2651
*Stone, Paul S., Extn. Instructor, Extn. Economist, Agri. Econ. 220 Patterson; 1405 Ashburton Rd.	2724	828-9805
*Stoner, Tina R., Secretary, Agri. Econ. 3 Patterson; Q-316 McKimmon Village	2612	
*Stoops, Robert F., Res. Prof. of Ceramic Engr., Engr. Research 1 Riddick Annex; 3705 Corbin St.	2347	787-3315
*Stott, Charles C., Asst. Prof., Rec. & Park Admin. 105-A Field House; 1017 Gardner St.	2247	TE4-6972
Stott, Estelle H., Clerk, Agri. Information 3311 Ricks; 2208 Hope St.	2804	832-7056
Stott, Juanita, Asst. to Director, Admissions & Registration 11 Peele; 2208 Hope St.	2436	832-7056
*Strickland, Betty M., Clerk, N.R.R.C. 505 Oberlin Road, Room 100; Rt. 2, Zebulon	2866	
*Strickland, Corbett, Res. Asst., Poultry Science 30 Scott; 108 Hoke St.	2628	
Strickland, Margaret F., Steno., Food Science 204 Polk; 2416 Derby Dr.	2778	828-9916
*Strickland, Mary Alice W., Agri. Res. Tech., Crop Science 484 Williams; 423 Fenton St.	2652	TE4-0691
*Strickland, Mary M., Typist, Business Affairs B Holladay; 212 S. Harrison Ave., Cary	2129	467-9564
*Strickland, Roderick P., Res. Asst., Crop Science 139-A Williams; Rt. 1, Zebulon	2638	AN9-9322
*Strider, David L., Assoc. Prof., Plant Pathology Mt. Hort. Crops Res. Station, Fletcher; 3246 Charlyne Dr., Hendersonville	Fletcher 692-1630	OX2-3473
*Stroud, George R., Textile Res. Tech., Textiles 303 Nelson Textile; Rt. 2, Wake Forest	2560	395-2041
*Struble, Raimond A., Professor, Mathematics 323 Harrelson; 4708 Yadkin St.	2389	787-0504
*Stuart, Archie D., Extn. Prof. in Crop Science, Agri. Mission to Peru 1 Patterson, N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Stuart, Duncan R., Professor, Design 306-A Brooks; 3330 Friar Tuck Rd.	2205	TE4-6538
Stuart, William B., Forest Management Ext. Specialist, Extension Forestry 55 Kilgore; 125 Woodburn Rd.	2891	833-5800

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Stuckey, Jasper L., Prof. Emeritus, Geological Engr., Mineral Industries 1911 Sunset Drive		TE2-0187
*Stuckey, William C., Jr., Prof. Emeritus, Geological Engr., Mineral Ind. B-52 Nelson Textile; 1537 Dellwood Dr.		TE2-0187
*Sturdivant, Thomas I., Machine Oper., General Extension 130-131 1911 Building; 2827 Corwin Rd.	2263	832-5689
Sturges, Frances V., Steno., Industrial Education 111-B Tompkins; 225 East Lane St.	2241	828-7389
*Styons, William R., Student Accounts Superv., Business Affairs B Holladay; 2308 Bernard St.	2156	TE3-7545
*Suberman, Jack, Director of Summer Sessions and Professor, English 101 Peele; 5313 Coronado Dr.	2864	787-1794
*Suddarth, Stanley K., Visiting Prof., Wood Sci. & Tech. 62 Kilgore; 403 Furches St.	2887	833-7653
Sugg, Margaret A., Steno., Acquisitions 112 Library; Apt. 5, 2316 Hillsboro St.	2841	832-8639
*Sugg, Marie B., Accounting Clerk, Business Office 4 Holladay; 115 Adams St., Cary	2149	467-1622
*Suggs, Charles W., Assoc. Prof., Agri. Engr. 132 Agri. Engr., 1507 Walnut Tr.	2663	TE4-0400
*Suggs, Faye D., Res. Asst., Poultry Science 213 Scott; Rt. 1, Hillsdale Forest, Cary	2627	467-1702
Sullivan, Donald B., Data Processor, Business Affairs 2 Holladay; RFD #1, Selma	2140	965-2053
*Summerville, K. O., Res. Asst., Forestry 54 Kilgore; 3031 Medlin Dr.	2887	787-3364
†Sumner, Baye M., Director, Telephone Services Leazar; A-1 Raleigh Apts.	2141, 2142, 2143	TE3-7580
*Sutherland, J. G., USDA Professor, Agri. Econ. 201-A Patterson; 1016 Faircloth St.	2604	833-7244
Sutherland, Mary C., Secretary; Engineering Placement Center 239 Riddick; 2222 Watkins St.	2318	TE2-4508
*Sutton, Edna L., Stockroom Clerk, Chemistry 217 Withers; 3012 Grant Ave.	2547	TE3-6308
*Sutton, Paul P., Professor, Chemistry 113 Withers; 1115 Wake Forest Rd.	2546	TE3-5384
Suval, Stanley, Asst. Prof., History & Political Science 108 Harrelson; 3109 Hillsboro St.	2481	828-4597
*Swain, L. Hall, Assoc. Prof., English 212 Winston; 2268 Circle Dr.	2463	832-0073
*Swaisgood, Harold E., Asst. Prof., Food Science 130 Polk; 2340 Lyon St.	2777	833-9604
*Swann, Ralph C., Professor & Head, Chemistry 107 Withers; 2109 St. James Rd.	2545	828-8777
*Swanson, Ernst W., Professor & Head, Economics 121 Harrelson; 1417 Powell Dr.	2471	828-6181
*Swatek, Captain J. F., USAF, Asst. Prof., Aerospace Studies 145 Coliseum; 4900 Lakemont Dr.	2417, 2419	787-2945
*Swicegood, Myrle L., District Home Economics Agent, Agri. Extn. 205 Ricks; 109 N. King Charles Rd.	2708	833-6759
*Swiger, James R., Personnel Officer, Personnel Primrose; 3221 Lewis Farm Rd.	2135	787-4208
*Swofford, Peggy T., Steno., Agri. Extn. 301 Ricks; 3209 Ingram Dr.	2789	828-4809

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone

T

*Talley, Banks C., Jr., Director, Student Activities 202 Peele; 821 Runnymede Rd.	2443	TE2-3012
Tart, Delorah M., Secretary, Rural Soc. 333 1911 Building; 1082 Nichols Dr.	2701	TE4-8790
*Tart, Shirley S., Key Punch Oper., Computing Center 11-G Nelson Textile; Rt. 3, Wake Forest	2518	TE3-4218
*Tarver, Fred R., Extn. Assoc. Prof., Food Science 202 Polk; 500 Cardinal Dr.	2779	828-6841
*Tate, Brita M., Asst. Program Director, Erdahl-Cloyd Union Erdahl-Cloyd Union; 800 Lake Raleigh Rd.	2454, 2451	834-0919
*Taylor, E. Wayne; Asst. Prof., Architecture 100 Brooks; 911 Deboy St.	2205	828-2744
*Taylor, Edward H., Agri. Res. Asst., Animal Science Animal Husbandry Farm; Rt. 8, Raleigh		833-8417
*Taylor, Ellen C., Secretary, Agri. Extn. 306 Ricks; 3039 Lewis Farm Rd.	2784	
*Taylor, H. W., Director, Alumni Affairs 103 Alumni; 2820 Bedford Ave.	2869, 2860	832-3274
*Taylor, James C., Jr., Agri. Res. Superv., Horticultural Science Horticultural Greenhouses; 609 S. Lakeside Dr.	2685	TE2-6585
*Taylor, Jeanne H., Secretary, English 118 Winston; P. O. Box 374, 19 Poplar St., Cary	2464	467-1527
*Taylor, Ronald, Asst. Prof., Design 103 Brooks; 608 Mills St.	2204	834-7662
*Taylor, Stuart V., Agri. Res. Asst., Animal Science Animal Husbandry Farm; Rt. 8, Raleigh		834-3255
*Taylor, Thomas C., Instructor, Economics 139 Harrelson; 2717 Clark Ave.	2472	828-8346
*Teague, David B., Instructor, Mathematics 313 Harrelson; 911 St. Mary's St.	2389	834-8996
*Teel, Frances P., Typist, Business Affairs 205 Holladay; 2817 Morton Rd.	2120	TE4-1929
*Telfair, Peggy M., Auditing Clerk, Animal Science Dairy Records Processing Center, Leazar; 901 St. Mary's St.	2632	833-8189
*Tereszczenko, Jan, Asst. Prof., Architecture 313 Brooks; 2623½ Oberlin Rd.	2203	834-5577
*Terrell, Elizabeth F., Agri. Res. Asst., Genetics 347 Gardner; 2112 Gilliam Lane	2733	832-0436
†Terrell, Myrtle T., Accounting Clerk, Agri. Admin. 120 Patterson; 305 Dartmouth Rd.	2714	787-3269
*Terrill, Thomas R., Extn. Instructor, Crop Science 430 Williams; 121 Byrum St., Cary	2642	467-9020
*Terry, David L., Res. Instructor, Soil Science 408 Williams; 2307 Derby Dr.	2645	828-5036
*Terry, Laura R., Secretary, Chemistry 108 Withers; 3501 Carolyn Dr.	2545	828-6436
†Tew, Margaret A., Clerk, Business Affairs Holladay; 1314 Glenwood Ave.	2156	TE2-3177
*Tew, Raymond E., Director, Engineering Placement Center 239 Riddick; 409 Latimer Rd.	2318	787-0454
*Thacker, Richard W., Agri. Res. Tech., Botany & Bacteriology 227 Gardner; Rt. 1, Box 15, Clayton	2726	922-7260
*Tharrington, Carol H., Accounting Clerk, Business Affairs 4 Holladay; 1213 Park Ave., Garner	2149	362-5341

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Thomas, Cecil D., Research Stations, NCDA, Agriculture N. C. Dept. of Agriculture; 704 Beaver Dam Rd.	829-3236	833-9747
*Thomas, Frances T., Administrative Secretary, Alumni Affairs 104 Alumni; 704 Beaver Dam Rd.	2860, 2869	833-9747
*Thomas, Frank B., Extn. Assoc. Prof., Food Science 204A Polk; 2704 Lakeview Dr.	2779	787-2855
*Thomas, Horace C., Military Property Custodian, Military Supply Frank Thompson Bldg.; 518 Powell Dr.	2427	TE2-2895
*Thomas, Jynell S., Steno., Crop Science 456 Williams; 2105 Timber Dr.	2652	TE2-7373
*Thomas, Mildred P., Textile Res. Tech., Textiles B-48 Nelson Textile; Rt. 6, Leesville Rd.	2565	787-2084
*Thomas, Richard J., Asst. Prof., Wood Sci. & Tech. 258 Kilgore; 801 Cornwall Rd., Cary	2885	467-4511
*Thompson, Donald L., Professor, Crop Science 139-A Williams; 1013 Pineview Dr.	2638	VA8-4927
*Thompson, Mary V., Clerk, Business Affairs Holladay; Rt. 2, Fuquay Varina	2129	
*Thompson, O. George, Asst. Prof., Economics 137 Harrelson; 3009 Mayview Rd.	2472	TE3-5046
*Thompson, Peggy S., Key Punch Oper., Animal Science Dairy Records Processing Center, Leazar; 1540 College Rd.	2632	TE2-3610
†Thompson, Roylene H., Secretary, Athletics 103 Coliseum; 704 Dixie Tr.	2104, 2108	832-6182
*Thomson, William A. B., Asst. Prof., Food Science 130 Polk; 1604 Franklin Rd.	2777	833-9079
*Thornton, Anne H., Cashier, Business Affairs B Holladay; 1317 Beaver Dam Rd.	2129	TE4-6073
*Thurlow, Edwin G., Professor, Landscape Architecture 214 Brooks; 3125 Darien Dr.	2204	TE3-7062
†Tiddy, Mildred B., Statistical Clerk, Agri. Econ. 205 Patterson; 4209 Western Blvd.	2724	834-7941
Tiddy, Sarah M., Nurse, Student Health Service Clark Infirmary; 4051 Brooks Ave.	2410	834-0856
*Tilley, Felton D., Asst. Purchasing Agent, Purchasing 106 1911 Building; 1322 Kent Rd.	2171	834-0467
*Timothy, David H., Assoc. Prof., Crop Science 158-A Williams; 13 Furches St.	2657	TE4-5161
*Ting, Tsuan Wu, Assoc. Prof., Mathematics 229 Harrelson; 4401 Camelot Dr.	2385	787-1962
Titus, Harold L., Asst. Prof., Modern Languages 309 Harrelson; Knightdale	2475	266-1197
*Todd, Furney A., Extn. Prof., Plant Pathology 13 Gardner; Rt. 2, Wendell	2711	365-7321
*Tolar, Dianne Z., Secretary, Foundations & Development 12 Holladay; 1021 St. Mary's St.	2846	828-8673
Tolley, G. S., Professor, Agri. Econ. 201-B Patterson; 902 Lake Boone Tr.	2604	834-5900
*Tolson, Linda S., Data Processor, Business Affairs 2 Holladay; 2618 Kilgore Ave.	2140	828-7646
*Tomlin, Wilbur H., Maintenance Mech., Chemical Engr. 7 Riddick; 314 Dry Ave., Cary	2328	467-1790
*Tomlinson, Sue P., Library Asst., Circulation Processing Library; 606 Glenbrook Dr.	2845	832-0810
*Toole, William B., III, Asst. Prof., English 209 Winston; 1889 West Smallwood Dr.	2463	833-5842

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Toomey, W. Glenn, Extn. Instructor, Crop Science 451 Williams; 909 Warren St., Cary	2641	467-9944
*Topakoglu, H. Cavit, Asst. Prof., Mechanical Engr. 23 Broughton; 702 Ryan Cr.	2366	834-2415
*Torrence, James F., Operations Engineer, Nuclear Reactor Project 24 Burlington Nuclear Lab.; 929 Tower St.	2321	TE4-5867
*Torrence, Nancy B., Steno, Auxiliary Services 207 Holladay; 4114 Gregory Lane, Rt. 2	2157	834-7413
*Toussaint, W. D., Professor, Agri. Econ. 215 Patterson; 3421 Blue Ridge Rd.	2609	787-4028
*Tove, Samuel B., Res. Prof., Animal Science 342 Polk; 2133 Buckingham Rd.	2773	833-2676
*Travis, Charles J., Res. Analyst, Industrial Extn. Service B-3 IES Building; 1114 N. King Charles Rd.	2358	834-0694
*Travis, John E., Industrial Specialist, Industrial Extn. Service 2-B IES Building; Route 7, Cary	2356	467-1273
*Travis, Ruby F., Auditing Clerk, Animal Science Dairy Records Processing Center, Leazar; 361 Meredith St.	2632	833-2739
*Triantaphyllou, Anastasios C., Assoc. Prof., Genetics 6 Gardner; 901 Merrie Rd.	2722	833-7728
*Triantaphyllou, Hedwig H., Assoc. Prof., Plant Pathology 2 Gardner; 901 Merrie Rd.	2722	TE3-7728
*Troxler, Robert T., Asst. Prof., Industrial Arts 108 Tompkins; 2812 Mayview Rd.	2237	TE3-1513
*Troyer, James R., Assoc. Prof., Botany, Botany & Bacteriology 246 Gardner, 517 General Laboratory; 814 Chamberlain St.	2726, 2541	833-3190
*Truitt, Robert W., Professor & Head, Mechanical Engr. 211 Broughton; 2405 Tyson St.	2365, 2366	787-4569
*Trumbo, Margaret D., Library Asst., Catalog 109 Library; 2434 Greenway Terrace	2841	VA8-4525
*Tucker, George E., Asst. Prof., Industrial Engr. 328 Riddick; 2112 Dunhill Dr.	2363	VA8-3410
†Tucker, Inez D., Secretary, Extension Forestry 262 Kilgore; 307 West Park Dr.	2891	833-7457
Tucker, Paul A., Jr., Res. Instructor, Textiles B-1 Nelson Textile; 1308 Ashburton St.		828-5608
*Tucker, William P., Asst. Prof., Chemistry 304-A Withers; 5133 Melbourne Rd.	2549	833-0477
*Tulloch, Linda S., Steno., Food Science 116 Kilgore; 2909 Wade Ave.	2691, 2692	VA8-6070
*Tunstall, Lena F., Steno., Animal Breeding, Animal Science 231 Polk; 2814 Mayview Rd.	2768	TE3-1627
*Tunstall, Shelton; Agri. Res. Superv., Genetics 230 1911 Building; 1014 Norris St.	2661	833-5545
Turner, Anne L., Chief Bibliographer, Library 108 Library; 903 West Johnson St.	2842	TE2-6997
*Turner, Bessie B., Switchboard Superv., Tel. Exch. 116 Winston; 308 Northwood Dr.	0	787-2617
*Turner, Carl B., Instructor, Economics 127 Harrelson; G-3A University Apts., Durham	2472	489-8876
Turner, Vance R., Agri. Res. Asst., Crop Science 488 Williams; Rt. 1, Raleigh	2652	TE3-2965
*Turner, William L., Business Manager, Business Affairs 109 Holladay; 2830 Barmettler St.	2145	TE4-1422
*Turnipseed, G. F., Asst. Prof., Entomology Moravian Falls		833-5739

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Twombly, Louis T., Visiting Extn. Livestock Advisor, Agri. Mission to Peru 1 Patterson; N. C. Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Tyler, Sue D., Steno., Extn., Plant Pathology 10 Gardner; 23 Simmons Apt., Wake Forest	2711	556-9001

U

*Ufen, Charles H., Instructor, Economics 133 Harrelson; 1617 Lorraine Rd.	2472	TE3-0251
*Ulberg, Lester C., Professor, Animal Breeding, Animal Science 231 Polk; 812 Ravenwood Dr.	2768	834-8455
Umstead, Carlisle P., Agri. Res. Asst., Plant Pathology 111 Gardner; 1020 Faircloth St.	2737	TE2-1251
*Underwood, Von Harvey, Res. Instructor, Horticultural Science 234 Kilgore; 332 Dry Ave., Cary	2669	467-1928
*Unwin, Charles D., Sergeant, USA, Military Science 154 Coliseum; 5237 Vann St., W	2428, 2429	828-5069
*Upchurch, Marilyn M., Instructor, English 112 Winston; 707 Beaver Dam Rd.	2464	828-2431
*Upchurch, Mildred M., Typist, Purchasing 102 1911 Building; Rt. 3, Raleigh	2171	828-3120
*Upchurch, Robert P., Professor, Crop Science 457-A Williams; 2112 Kipawa St.	2642	787-4029
*Upchurch, Woody, Asst. Editor, Agri. Information 314 Ricks; 5020 Lakemont Dr.	2805, 2809	787-1987
*Usry, Mary F., Self-Help Work Counselor, Counseling 205 Peele; 2810 Mayview Rd.	2421	TE3-5185
*Uyanik, Mehmet E., Professor, Civil Engr. 318 Mann; 3516 Andrews Ln.	2333	787-4718
*Uzzle, Ruby P., Extn. Asst. Prof. in Agri. Economics, Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	

V

*Van Anda, Judy N., Steno., Zoology 155 Gardner; J-25, McKimmon Village	2741	832-3220
*van der Vaart, Hubertus Robert, Professor, Experimental Statistics & Mathematics 513-A General Laboratory & 337 Harrelson; 1212 Brooks Ave.	2541	832-6009
*Verbeck, Arthur R., Res. Instructor, Textiles S-61 Nelson Textile; 3007 Leonard St.	2571	834-0973
*Verghese, Kuruvilla, Asst. Prof., Nuclear Engr. 235 Riddick; 3801 Harris Rd.	2304	TE3-6652
*Verlinden, Francis J., Res. Assoc. Tech., Experimental Statistics 608-F General Laboratory; 106 Bryon Pl.	2534	TE4-2119
†Via, James E., Extn. Instructor, Extn. Economist, Agri. Econ. 10-B Patterson; 530 E. Cornwall Rd., Cary	2603	467-3842
*Vick, Mary Catharine V., Library Asst., Serials 12 Library; 2373 McMullan Cr.	2842	833-0720
*Vincell, Edgar E., Sergeant, USA, Military Science 154 Coliseum; 207 E. Whitaker Mill Rd.	2428, 2429	TE2-4746
*Volk, Richard J., Assoc. Prof., Soil Science 383-C Williams; 1009 Pineview Dr.	2649	TE4-9017

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone

W

*Waddell, DeLavalette R., Accounting Clerk, Agri. Extn. 120-B Patterson; 814 Braden St.	2601	TE3-9233
*Wade, James A., Agri. Res. Asst., Crop Science 452 Williams; 2213 Noble Rd.	2641	TE2-6454
Wade, Virginia, Res. Analyst, Entomology 325 Gardner; 2415 Everett Ave.	2748	832-4114
*Wagoner, Fred H., 4-H Club Specialist, Agri. Extn. 202 Ricks; 1318 Lutz Ave.	2802, 2803	TE4-2979
Wagoner, Thomas L., Agri. Res. Asst., Animal Breeding, Animal Science Reproductive Physiology Lab.; 1216 Franklin Rd.	2673	833-6016
*Wahl, George H., Jr., Asst. Prof., Chemistry 102 Withers; 1009 Powell Dr.	2549	833-8205
*Wahls, Harvey E., Assoc. Prof., Civil Engr. 215 Mann; 4712 Glen Forest Dr.	2332	787-0585
*Waits, Elizabeth L., Agri. Res. Tech., Food Science 137 Polk; F-22 McKimmon Village	2795	828-9616
*Walker, Edward, Mail Clerk, Library Library; 705 Bunche Dr.	2842	TE3-4332
*Walker, J. L., Visiting Asst. Prof., Soil Science (AID) 101 Williams; c/o Ministero de Agricultura Institute Agropecuarie Nacional "La Aurora" Guatemala, Z, 13, Guatemala, C.A.	2630	
*Walker, Norma M., Secretary, Summer Sessions 103 Peele; 601½ Powell Dr.	2864	834-4014
*Wall, O. Glen, Jr., Asst. Manager, Animal Science Dairy Records Processing Center, Leazar; 3337 Friartuck Rd.	2632	833-7240
*Wallace, James C., Asst. Prof., Social Studies 149 Harrelson; King's Mill Rd., Chapel Hill	2479	942-1122
*Wallace, Mary A., Administrative Asst., Business Affairs B Holladay; 509 Cole St.	2148	TE2-9566
*Wallace, T. D., Assoc. Prof., Agri. Econ. & Experimental Statistics 203-C Patterson; 1491 Lorimer Rd.	2605	834-2352
*Waller, Jerry M., Instr., Metallurgical Engr., Mineral Industries 110 Page; 904 Kathryn St., Cary	2377	467-1396
Walser, Richard G., Professor, English 7-9 Winston; 3929 Arrow Dr.	2461	787-4771
Walsh, William K., Res. Asst., Textiles S-53 Nelson Textile; 2622 Bedford Ave.	2550	832-1893
*Walters, Thomas N., Instructor, English 218-20 Winston; 3044 Farrior Rd.	2463	832-8168
*Waltner, Arthur W., Professor, Physics 402 General Laboratory; 1612 Lorraine Rd.	2514	TE3-0766
*Walton, Marie P., Steno., Food Science 204 Polk; 1205 Vandora Springs Rd., Garner	2779	EM2-1236
*Walton, Martha, Technician, Zoology Reproductive Physiology Lab.	2673	833-0947
Wang, Fu T., Asst. Statistician, Experimental Statistics 513-E General Laboratory; 2402 Hillsboro St.	2541	TE3-9108
*Wang, Shou-ling, Assoc. Prof., Engr. Mechanics 317-A Riddick; 1020 Pineview Rd.	2343	VA8-4093
*Wang, Yi, Instructor, Agri. Econ. 201-C Patterson; 20 Bagwell Ave.	2604	834-8887
Ward, Charles A., Jr., Bookkeeper, Athletics 101 Coliseum; 612-D Woodburn Rd.	2101, 2104	828-2496

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
Ward, Elizabeth H., Secretary, Agri. Extn. 201 Ricks; 201½ Groveland Ave.	2788	832-6326
*Ward, Thomas M., Instructor, Chemistry 103 Withers; 2736 St. Mary's St.	2549	787-2996
*Warren, Frederick G., Professor, Food Science 128E Polk; 1339 Brooks Ave.	2794	834-4520
*Warren, Jerry A., Post-doctoral Fellow, Experimental Statistics 518-E General Laboratory; 5321 E. Lakeside	2541	832-2364
*Warrick, Woodley C., Extn. Assoc. Prof., Agri. Engr. 211 Agri. Engr.; Rt. 2, Clayton	2676	922-6529
*Washburn, J. Dan, Agri. Res. Superv., Crop Science 192 Williams; Rt. 8, Box 268, Raleigh	2657	787-2940
†Waters, Elsa C., Statistical Clerk, Agri. Econ. 211 1911 Building; 2502 Clark Ave.	2617	834-8851
*Waters, Shirley H., Steno., Genetics 353 Gardner; 804 Merrie Rd.	2731	834-2365
*Watkins, Fred N., Maintenance Mechanic, Textiles 222 Nelson Textile; Rt. 3, Wake Forest	2568	834-2864
Watkins, Joyce, Res. Asst., Poultry Science 118 Scott; 4815 Montacute St.	2624	832-4550
*Watkins, Rupert W., Extn. Asst. Prof., Agri. Engr. 202 Agri. Engr.; Rt. 1, Clayton	2677	934-7793
*Watson, George C., Assoc. Prof., Mathematics 212 Harrelson; 3134 Sussex Rd.	2381	787-4639
*Watson, J. Perry, Director, Music 104 Pullen; 932 Beverly Dr.	2401	828-6527
*Watts, Harold M., Supervisor, Laundry Laundry; 307½ Marsh Ave.	2122	834-5870
*Watts, Norbert B., Director, Student Housing 203 Peele; Rt. 8, Box 183, Raleigh	2406, 2642	787-4415
*Waugh, D. L., Visiting Asst. Prof., Soil Science (AID) 101 Williams; c/o Estacion Experimental Agraciola de la Molina Apartado 2791, Lima, Peru	2630	
*Waugh, Edward W., Arch. & Campus Plan., Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Weant, Jacquelyn E., Typist, Placement Center Riddick; 301 Bickett Rd.	2318	787-0420
*Weathers, C. R., Extn. Assoc. Prof., Extn. Economist, Agri. Econ. 220 Patterson; 614 Union St., Cary	2724	467-9268
*Weathers, James A., Jr., Internal Auditor, Business Affairs 11 Holladay; 1336 Canterbury Rd.	2158	787-6576
*Weaver, David S., Prof. Emeritus & Chairman, Soil & Water Consv. Comm., Agri. & Life Sciences 112 Patterson; 520 Gardner St.	2668	TE2-4110
*Weaver, Jean B., Secretary, Financial Aid 205-A Peele; 414 Morrison Ave.	2421	833-4105
*Weaver, John W., Jr., Professor, Agri. Engr. 109 Agri. Engr.; 414 Morrison Ave.	2696	834-4105
*Weaver, Ronald G., Instructor, Physical Education Carmichael Gymnasium; 5024 Wickham Rd.	2487	828-7460
*Webb, Benjamin D., Instructor, Fresh. Engineering Division 271 Broughton; 5117 Kaplan Dr.	2387	VA8-2976
*Webb, Nancy H., Personnel Asst., Personnel Primrose; 5900 Deblyn Ave.	2135	787-3144
*Webb, Sybil B., Secretary, Graduate School 104 Peele; 3040 Farrior Rd.	2871, 2872	833-8963

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
Webber, Jane A., Steno., Chemistry 108 Withers; 124½ East Park Dr.	2545	834-7193
*Weber, Jerome B., Asst. Prof., Crop Science 453-A Williams; 2901 Claremont Rd.	2642	833-1080
*Webster, Charles D., Sergeant, Military Science 154 Coliseum; 312 S. Lombard St., Clayton	2428, 2429	922-7882
Webster, Linda L., Agri. Res. Tech., Animal Science 340 Polk; 1086 Nichols Dr.	2773	834-1000
*Weed, Sterling B., Assoc. Prof., Soil Science 324 Williams; 5036 New Castle Rd.	2636	834-8953
Weedon, J. Franklin, Sports Information Director, Athletics 124 Coliseum; 2304 Mayview Rd.	2102	828-5070
*Weems, Robert D., Electronic Computer Programmer, Experimental Statistics 612-F General Laboratory; 5240 Vann St.	2531	832-4419
Welch, Linda G., Steno., Engineering 229 Riddick; 2208-D Garden Pl.	2312	833-5252
Weldon, N. W., Asst. Prof. Emeritus, Agri. Engr. Stovall, N. C.		
*Wellman, Frederick L., Visiting Prof., Plant Pathology 4 Gardner; 1504 Ridge Rd.	2721	787-4887
*Wells, Bertram W., Emeritus Faculty, Botany & Bacteriology Rt. 2, Wake Forest		
*Wells, J. C., Extn. Prof., Plant Pathology 12 Gardner; King Lawrence Rd., Rt. 8	2711	TE3-6040
*Welt, Martin A., Director, Nuclear Reactor Project 31 Burlington Nuclear Lab., 317 Glen Valley Dr.	2321, 2322	787-0802
*Wernsman, Earl A., Asst. Prof., Crop Science 429-A Williams; 3309 Octavia Rd.	2642	828-8343
Wesler, Oscar, Professor, Experimental Statistics & Mathematics 614-G General Laboratory; 1926 Smallwood Dr.	2531	832-6943
*West, D. A., Asst. Prof., Agri. Econ. 6-A Patterson; 229 Furches St.	2607	832-2102
*West, John R., Extn. Poultry Specialist, Poultry Science 214 Scott; 4130 Western Blvd.	2621	828-7789
Westbrook, Linda C., Secretary, Extn., Agri. Engr. 204 Agri. Engr.; 411 Calvin Road	2678	832-2420
*Westmoreland, Grover W., Extn. Dairy Husb., Animal Science 104-A Polk Hall; 733 Chappell Dr.	2771	834-4788
*Weston, Wilbur F., Jr., Counselor, Counseling 207 Peele	2424	
*Weybrew, Joseph A., Professor, Crop Science 407 Williams; 711 E. Pineland Dr.	2635	832-7053
*Wheeler, John L., Visiting Assoc. Prof., Animal Science 245 Polk; 2303 Clark Ave.	2763	
*Whisenant, Capt. B. E., USAF, Asst. Prof., Aerospace Studies 145 Coliseum; 4509 Sampson St.	2417, 2418	787-2202
*Whitbread, Robert, Visiting Asst. Prof., Plant Pathology 29-A Gardner; 2805 Everett Ave.	2722	834-8897
*White, Dennis E., Res. Asst., Poultry Science Poultry Research Farm, College Rd.; 1209 College Rd.	2729	828-5321
White, Elizabeth S., Res. Tech., Horticultural Science 225 Kilgore; 901 Glenwood Ave., Apt. 4	2669	828-9887
*White, R. Benjamin, Jr., Asst. Prof., English 218-20 Winston; Route 1, Holly Dr.	2463	828-3687
*White, Raymond C., Professor, Chemistry 115 Withers; 1509 Lutz Ave.	2546	TE3-5424

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*White, Thomas K., Visit. Instr. in Agri. Econ., Agri. Mission to Peru 1 Patterson; N. C. State Agri. Mission to Peru, Apartado 2791, Lima, Peru	2671	
*Whitehurst, Sarah W., Secretary, District Agents 305 Ricks; 5445 Penwood Dr.	2780	828-3909
*Whitenberg, David C., Asst. Prof., Crop Science 451-A Williams; 2606 Kilgore Ave.	2642	832-3211
*Whiteside, Donald, Instructor, Soc. & Anthro. 355 Harrelson; 2300 Byrd St.	2491	834-1275
*Whitfield, Fred E., Forest Mgt. Ext. Specialist, Extension Forestry 268 Kilgore; 1324 Ridge Rd.	2891	VA8-6503
Whitfield, Hazel B., Secretary, Military Science 154 Colisuem; B-4 Wilmont Apts., 3200 Hillsboro St.	2428, 2429	TE3-1869
*Whitfield, John K., Assoc. Prof., Mechanical Engr. 319 Broughton; 3605 Swann Dr.	2372	787-1128
*Whitford, Larry A., Professor, Botany, Botany & Bacteriology 265 Gardner; 3217 Oak Grove Cir.	2725	787-4776
*Wiggins, Robert E., Assoc. Prof., Textiles 107-B Nelson Textile; 3417 Wade Ave.	2569	833-7981
*Wiggs, Joseph T., Agri. Res. Superv., Horticultural Science Horticultural Greenhouses; 33 Dixie Dr.	2685	TE3-3474
*Wilburn, Craig R., Typist-Clerk, Agri. Information 15 Ricks; 825 Carlisle St.	2791	
*Wilder, G. Ray, Agri. Res. Asst., Plant Pathology 111 Gardner; Poplar Street, Box 52, Wendell	2737	FO5-7228
*Wilder, Isabelle N., Steno.-Clerk, Agri. Information 3 Ricks; 14 Daisy St.	2862	834-1128
*Wilder, William A., Jr., Instructor, Animal Science 211 Polk; Knightdale	2763	CO6-2835
*Wiles, John F., Extn. Instructor, Food Science 201 Polk; 4205 Laurel Hills Rd.	2778	787-0449
*Wilkerson, Ruby L., Steno., Industrial Education 111-B Tompkins; 805 Culpepper Ln.	2241	833-0895
*Willard, Rudolph, Visiting Lecturer, Industrial Engr. 339 Riddick; S-3 Raleigh Apts.	2362	TE2-7747
*Wiley, Cliff R., Asst. Prof. USDA, Agri. Engr. 147 Agri. Engr.; Rt. 7, Raleigh	2663	833-1359
*Williams, Betty B., Steno., Agri. Extn. 4-H Club 204 Ricks; A-24 McKimmon Village	2802, 2803	
Williams, Betty J., Secretary, Student Activities 202 Peele; 124½ E. Park Dr.	2441	834-7193
*Williams, Carlos F., Prof. Emeritus, Horticultural Science 1912 Lewis Cir.		TE2-0233
*Williams, Charles W., Asst. Bus. Mgr., Business Affairs 100 Holladay; Reedy Creek Rd., Cary	2146, 2147	467-1541
*Williams, Evelyn D., Secretary, Agri. Admin. 115 Patterson; 603 Vick Ave.	2613	787-2906
*Williams, Gertrude H., Secretary, Agronomy Extension 155 Williams; 717 Edmund St.	2654	833-9682
*Williams, H. Page, Prof. Emeritus, Mathematics 226 Tompkins; 1015 Brooks Ave.	2385	832-2191
*Williams, James C., III, Assoc. Prof., Mechanical Engr. 117 Broughton; 1009 Westwood Dr.	2373	787-4479
*Williams, John C., Purchasing Agent, Purchasing 107 1911 Building; 4313 Boxwood Rd.	2171	787-0232
*Williams, John R., Res. Sta. Superv., Animal Science Central Research Station, Western Blvd.; 3614 Western Blvd.	2713	828-7519

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Williams, Justina H., Agri. Res. Asst., Genetics 358 Gardner; 1425 E. Lane St.	2733	832-5163
*Williams, Mary C., Special Lecturer, English 217-19 Winston; 622 Woodburn Ave.	2463	833-3805
Williams, Porter, Jr., Assoc. Prof., English 213 Winston; 222 Hawthorne Rd.	2463	832-5120
*Williams, Sam, Agri. Res. Asst., Animal Science Animal Husbandry Farm; Rt. 8, Raleigh		
*Williams, W. Marvin, Agri. Res. Asst., Plant Pathology 107 Gardner; 602 Virginia Ave.	2736	834-1243
*Williamson, James C., Jr., Professor, Agri. Econ., Asst. Director of Res. & Extn., Agri. Extn., Agri. Expt. Station 112 Ricks; 2210 Wheeler Rd.	2814	787-4139
*Williamson, Lynell, Stock Clerk, Textiles 123 David Clark Labs., 116 Maple St.	2555	834-2649
†Williamson, Marie E., Steno., Textiles B-21 Nelson Textiles; 309 W. Whitaker Mill Rd.	2564, 2565	833-2678
*Williamson, Ralph E., Asst. Prof., USDA, Agri. Engr. 140 Agri. Engr.; 716 Currituck Dr.	2662	787-2089
*Willson, Ann J., Agri. Res. Asst., Genetics 347 Gardner; 2304½ Hale's Rd.	2733	834-7400
*Wilson, Elizabeth H., Agri. Tech., Plant Pathology 201 Kilgore; 2035 Timber Dr.	2660	828-2573
Wilson, Evelyn B., Statistical Aide, Experimental Statistics 510 General Laboratory; 1037 Nichols Dr.	2541	832-3591
*Wilson, Jack W., Asst. Prof., Economics 133 Harrelson; 5032 Kaplan Dr.	2472	828-0468
*Wilson, James B., Assoc. Prof., Mathematics 234 Harrelson; 341 Wilmot Dr.	2384	834-3942
†Wilson, Jane H., Secretary, Student Affairs 101 Holladay; 2204 St. Mary's St.	2446	TE2-2060
*Wilson, Lucy C., Librarian, Tobacco Literature Service 234 Library; 1101 Lakeside Dr., Garner	2705	362-5741
Wilson, S. Virginia, In Charge, Foods & Nutrition, Agri. Extn. 213 Ricks; 1121 Harvey St.	2786	832-3216
*Wilson, Thomas L., Prof. Emeritus, English 223 Winston; 407 Calvin Rd.	2463	832-6951
*Wilson, Major Woodrow O., Asst. Prof., Military Science 154 Coliseum; 2612 Avent Ferry Rd.	2428, 2429	828-7747
*Winchester George L., Jr., Res. Asst., Engr. Research 4 Riddick Annex; 3010 Leonard St.	2347	832-2165
*Wing, Myrtle S., Agri. Res. Tech., Genetics 358 Gardner; 708 Glascock St.	2733	834-2738
*Winkler, Edwin W., Assoc. Prof., Electrical Engr. 227 Daniels; 509 Gardner St.	2338	832-1370
*Winstead, Nash N., Professor, Plant Pathology 208 Gardner; 1109 Glendale Dr.	2751	TE3-5575
*Winston, Sanford R., Professor, Soc. & Anthro. 311 Harrelson; 1712 Piccadilly Ln.	2491	TE2-1402
*Winteringham, Francis P. W., Visiting Prof., Entomology 136 Gardner; 401 Plainview	2746	834-1522
*Winton, Lowell S., Professor, Mathematics 202 Harrelson; 3007 Mayview Rd.	2383	TE3-4763
*Wise, George H., Professor & Head of Nutrition Section, Animal Science 319 Polk; 229 Woodburn Rd.	2773	833-9262

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Wise, Milton B., Professor, Animal Science 220-A Polk; 633 S. Lakeside Dr.	2763	828-3319
*Wiser, Edward H., Instructor, Agri. Engr. 148 Agri. Engr.; 404 Dixie Tr.	2663	TE4-2114
Wishon, Brenda F., Res. Asst., Poultry Science 110 Scott; Peele Pl.	2624	833-1269
Wodehouse, Lawrence M., Asst. Prof., Architecture 212 Brooks; Pine St.	2203	
*Wolf, Sara H., Library Asst., Catalog 109 Library; 2963 Winchester Ct.	2841	828-9955
*Woltz, W. G., Professor, Soil Science 426 Williams; Oxford, N. C.	2645	2-3441
Womble, Charlotte M., In Charge, Extension Housing and House Furnishings, Agri. Extn. 210 Ricks; 308 Horne St.	2785	828-5216
Wood, Carol R., Library Asst., Acquisitions 112 Library; 1001 W. Peace St.	2841	832-4914
*Wood, Lester O., Dairy Plant, Food Science Basement Polk; 332 John St., Clayton	2700	WA2-7314
Wood, Lottie B., Clerk, Admissions & Registration 7 Peele; 3200 Hillsboro St.	2435	
*Wood, Robert N., Asst. Director of Foundations, Foundations & Development 12 Holladay; 519 Transylvania Ave.	2846	787-0037
*Wood, T. W., Professor, Economics 138 Harrelson; 2822 Bedford Ave.	2472	TE2-3800
†Woodall, Clyde H., Clerk, Admissions & Registration 12-B Peele; G-2 Country Club Homes	2436	TE2-0381
*Woodall, Lilbron G., Agri. Res. Asst., Crop Science 158 Williams; Rt. 4, Raleigh	2657	TE4-0986
*Woodard, J. R., Extn. Assoc. Prof., Animal Husb. Extn. Spec., Animal Science 119 Polk; 608 Macon Pl.	2761	787-3669
*Woodard, Sue B., Accounting Clerk, Soil Science 222 Williams; Box 395, Spring Hope	2656	478-3255
*Woodburn, James, Professor, Mechanical Engr. 129 Broughton; 613 Macon Pl.	2368	787-2606
*Woodhouse, Margaret C., Director, International Student Center, Student Activities King Religious Center; 1511 Dixie Tr.	2414	832-4544
*Woodhouse, William W., Jr., Professor, Soil Science 188 Williams; 1511 Dixie Tr.	2657	TE2-4544
*Woodlief, Rodney-Ann D., Key Punch Oper., Business Affairs 2 Holladay; 500 Wayne Dr.	2140	828-9944
*Woodruff, J. R., Extn. Instructor, Soil Science Rt. 2, Box 22-K, Plymouth	Plymouth 793-2049	793-2870
Woodson, Stephani F., Steno., Rural Soc. Ext. 242 1911 Building; 1082 Nichols Dr.	2659	834-8790
*Woolard, Betty S., Accounting Clerk, Payroll, Business Affairs 206 Holladay; 2301 Milburnie Rd.	2151, 2152	828-4977
*Wooldridge, Oscar B., Coordinator of Religious Affairs, Student Activities King Religious Center; 3105 Churchill Rd.	2415, 2414	834-1082
*Work, Robert W., Director of Research, Textiles 115 David Clark Labs.; Hillcrest Cr., Chapel Hill	2554	942-6564
*Worsham, Arch D., Extn. Assoc. Prof., Crop Science 458 Williams; 1713 Jones Ave.	2641	832-4156

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone
*Worsley, George L., Jr., Asst. Budget Director, Business Affairs 103 Holladay; 307 Acorn St.	2155	834-5951
*Wray, Cheryl H., Art Assistant, Agri. Information 13 Ricks; 3340 White Oak Rd.	2862	834-0074
*Wright, Charles G., Asst. Prof., Entomology 336 Gardner; 4221 Arbutus Dr.	2748	787-1811
*Wright, Ernestine L., Accounting Clerk, Entomology 134 Gardner; 5252 Vann St.	2747	828-9927
*Wright, F. Scott, Res. Instructor, Agri. Engr. 139 Agri. Engr.; 317 Gary St.	2663	832-0784
*Wright, John D., Budget Officer & Director of Accounting, Business Affairs 103 Holladay; 4902 Brookhaven Dr.	2155	787-0252
*Wright, Margie E., Steno., Botany & Bacteriology 146 Gardner; 2700 Ashland Dr.	2725	828-0490
†Wyatt, Candace L., Dupl. Equip. Oper., Agri. Information 320 Ricks; 2702 Van Dyke Ave.	2808	828-9863
*Wyman, Lenthal, Prof. Emeritus, Forestry 1837 White Oak Rd.		TE2-8953
Wynne, Robert B., Assoc. Prof., English 111 Winston; 1411 Jackson St.	2464	833-1700

Y

Yancey, William A., Nuclear Electronics Tech., Nuclear Reactor Project 32 Burlington Nuclear Lab.; 4023 Raleigh-Durham Hwy.	2321	787-1991
†Yarborough, Jeanie B., Typist, Director's Office 126 Library; 2308 Van Dyke Ave.	2843	TE2-2332
*Yauger, Norma S., Library Asst., Circulation Library; P-217 McKimmon Village	2845	828-3186
Yeargan, D. Ray, Agri. Res. Asst., Plant Pathology 111 Gardner; Box 389, Rt. 1, Garner	2737	
*Yionoulis, Mary N., Public Information Officer, Engineering 243 Riddick; Rt. 6, Creedmoor Rd.	2340	787-1584
*Yip, Judy, Secretary, Agri. Econ. 6 Patterson; 701 E. Franklin St.	2607	828-2271
*Yorke, Carolyn H., Steno., Horticultural Science 226 Kilgore; 2619 Crestline Ave.	2669	833-4458
*Young, David A., Professor, Entomology 326 Gardner; 612 Buck Jones Rd.	2748	
*Young, Elizabeth M., Secretary, School of Design 200 Brooks; 2701 Toxey Dr.	2202	787-1370
*Young, James N., Asst. Dir. of Instruction, Agri. & Life Sciences 108 Patterson; 4211 Windsor Pl.	2667	787-3360
*Young, Malpheus F., Agri. Res. Superv., Crop Science 112 Williams; Rt. 4, Raleigh	2638	833-8707
*Young, Milton B., Res. Asst., Poultry Science Poultry Research Farm, College Rd.; Campbell Rd.	2729	833-5911
*Young, Talmage B., Assoc. Prof., Industrial Arts 106 Tompkins; 5249 Vann St.	2237	TE3-1096
*Younts, Bryce R., Administrative Officer, State Soil & Water Conservation Comm. 387 Williams; 1004 Pineview Dr.	2646	TE4-2195

* Married
† Widowed

Name, Title, Department, and Address	Office Phone	Res. Phone

Z

*Zaic, Carmen M., Director, Tobacco Literature Service 233 Library; 2307 McMullan Cr.	2705	828-8755
*Zeiger, Donald C., Asst. Prof., Horticultural Science 623 Lenox Place St., Hendersonville	Hendersonville 692-1630	692-1288
*Zielinski, Zenon A., Visiting Assoc. Prof., Civil Engr. 408 Mann; 905 Lake Boone Tr.	2332	833-0757
*Zobel, Bruce J., Professor, Forest Genetics, Forest Management 252 Kilgore; Holly Springs Rd., Rt. 4	2880	TE4-0090
*Zorowski, Carl F., Professor, Mechanical Engr. 229 Broughton; 4513 Pitt St.	2360	787-0937
*Zschau, Helen K., Asst. Librarian, School of Design 201 Brooks; 2125 Woodland Ave.	2207	TE2-8118

* Married
† Widowed

Seventy-sixth

Annual Commencement

North Carolina State,
of the University of North Carolina at Raleigh

Saturday, May 29
Nineteen Hundred and Sixty-five
Degrees Awarded 1964-65

Corrections on pages
20, 21, 23, 28, 39, 46

Musical Program

EXERCISES OF GRADUATION

MAY 29, 1965

CARILLON CONCERT: 9:30 A.M. — The Memorial Tower

Dennis L. Carroll, Carillonneur

NORTH CAROLINA STATE COMMENCEMENT BAND CONCERT: 9:45 A.M.

William Neal Reynolds Coliseum

March and Chorale ..... Washburn

Song of Jupiter ..... Handel

The Impresario, Overture ..... Mozart

Elsa's Procession to the Cathedral, from Lohengrin ..... Wagner

Coat of Arms, Concert March ..... Kenny

PROCESSIONAL: 10:15 A.M.

March Processional ..... Grundman

RECESSIONAL:

University Grand March ..... Goldman

NORTH CAROLINA STATE COMMENCEMENT BAND

Donald B. Adcock, Conductor

Exercises of Graduation

William Neal Reynolds Coliseum

May 29, 1965

PROCESSIONAL, 10:15 A.M. ——— Donald B. Adcock
Conductor, North Carolina State Commencement Band

The audience is requested to remain seated during the Processional.

PRESIDING ——— John T. Caldwell
Chancellor, North Carolina State

INVOCATION ——— Oscar B. Wooldridge
Coordinator of Religious Affairs
North Carolina State

ADDRESS ——— John T. Caldwell
Chancellor

CONFERRING OF DEGREES ——— John T. Caldwell
Chancellor
Harry C. Kelly
Dean of the Faculty

Candidates for baccalaureate degrees presented by Deans of Schools. Candidates for advanced degrees presented by Dean of the Graduate School. Candidates for honorary degrees presented by their sponsors.

ANNOUNCEMENT OF GOODWIFE DIPLOMAS ——— John L. Atkins, III
President of Student Government

ANNOUNCEMENTS OF OUTSTANDING TEACHER AWARDS ——— T. Edward Bailey
President, Class of 1965

REMARKS TO THE GRADUATING CLASS ——— William C. Friday
President, University of North Carolina

Dan K. Moore
Governor of North Carolina

ALMA MATER

BENEDICTION

RECESSIONAL

The audience is requested to remain seated until recessional music is concluded.

Social Hour and Distribution of Diplomas

1:30 P.M.

School and Department Locations

School of Agriculture & Life Sciences
- Agricultural Economics — 256-258 Erdahl-Cloyd Union
- Agricultural Engineering — 158 Agricultural Engineering Building
- Animal Science and Food Science — Fitzpatrick Room, 125 Polk Hall
- Botany and Bacteriology — 145 Gardner Hall
- Crop Science, Plant Protection, and Social Science — Williams Hall Auditorium and McKimmon Room, Williams Hall
- Horticultural Science — 125 Kilgore Hall and 121 Kilgore Hall
- Poultry Science — 224 Scott Hall
- Rural Sociology — 336, 1911 Building
- Zoology — 149 Gardner and 245 Gardner Hall

School of Design — 200 Brooks Hall

School of Education — Carmichael Gymnasium

School of Engineering
- Agricultural Engineering — 158 Agricultural Engineering Building
- Chemical Engineering — 115 Riddick
- Civil Engineering — Lobby of Mann Hall
- Electrical Engineering — 231 Daniels (Guests in 232 Daniels)
- Engineering Mechanics — 324 Riddick
- Furniture Manufacturing and Management — 242 Riddick
- Industrial Engineering — 234 Riddick
- Mechanical Engineering — Broughton Laboratories
- Mineral Industries — Memorial Room, Alumni Building
- Nuclear Engineering — Burlington Nuclear Laboratories

School of Forestry — 162 Kilgore Hall

School of Liberal Arts — Adult Recreation Room, Faculty Club

School of Physical Sciences and Applied Mathematics — 103 General Laboratory Building

School of Textiles — Nelson Textile Auditorium

ROTC Commissioning Ceremony

William Neal Reynolds Coliseum

May 29, 1965

PROCESSIONAL MARCH 3:00 P.M. ..... Donald B. Adcock
Conductor, North Carolina State Commencement Band

The audience is requested to remain seated until processional music is completed.

NATIONAL ANTHEM

INVOCATION ..... Malcom E. Smith
Chaplain (Captain), USAF

INTRODUCTIONS ..... John T. Caldwell
Chancellor, North Carolina State

ADDRESS ..... Winston P. Wilson
Major General, USAF
Chief, National Guard Bureau

ADMINISTRATION OF OATH OF OFFICE AND PRESENTATION OF CERTIFICATES OF COMMISSION ..... Colonel Lem M. Kelly, PMS
Colonel James D. Howder, PAS

BENEDICTION

Academic Costume

Academic gowns represent a tradition handed down from the universities of the Middle Ages. These institutions were founded by the Church; the students, being clerics, were obliged to wear the prescribed gowns at all times. Round caps later became square motarboards; the hoods, originally cowls attached to the gowns, could be slipped over the head for warmth.

Many European universities have distinctive caps and gowns which are different from those commonly used in this country. Some of the gowns are of bright colors and some are embellished with fur. A number of these may be noted in the procession.

The usual color for academic gowns in the United States is black. The bachelor's gown is worn closed, the master's and doctor's may be worn open or closed. The shape of the sleeve is the distinguishing mark of the gown: bachelor—long pointed sleeves; master—oblong, square cut in back with an arc cut away in front; doctor—bell-shaped.

Caps are black as are the tassels for B.A., B.S., and B.E. degrees; tassels for the Ph.D. degree are gold and those for other graduate and professional degrees may be of the color corresponding to the trimmings on the hoods.

The hoods are lined with the color of the institution from which the wearer received his degree. The trimming or collar of the hood is the color which designates the degree: Liberal Arts, white; Fine Arts and Architecture, brown; Science, golden yellow; Music, pink; Divinity, scarlet; Law, purple; Engineering, orange; Philosophy, blue; Medicine, green; Forestry, russet.

Honorary degree hoods are distinguished as follows: Master of Arts (M.A.), white; Doctor of Humane Letters (L.H.D.), white; Doctor of Science (Sc.D.), golden yellow; Doctor of Divinity (D.D), scarlet; Doctor of Laws (LL.D.), purple.

DEGREES CONFERRED

May 29, 1965

School of Agriculture and Life Sciences

BACHELOR OF SCIENCE IN AGRICULTURAL ENGINEERING

Jointly Administered by the School of Agriculture and Life Sciences and the School of Engineering

*Cecil Bruce Currin	Oxford
*Thomas Tazwell Cutts, III	Stovall
**Thomas Lynn Honeycutt	High Point
Michael Belton Hupko	Pinebluff
Gaines Howard Liner	Efland
James Wesley McMasters	Staley
†Jimmy Wayne Mabe	Kernersville
Roy Erwin Meece, Jr.	Asheville
Frank Dixon Perkinson, Jr.	Wise
*James David Smith	Benson

BACHELOR OF SCIENCE

Agricultural Economics

James Franklin Anderson	Goldsboro
Robert Raymond Andres, Jr.	Raleigh
Worth Wrenn Bagley	Kenly
Elmer Clyde Ball, Jr.	Elkin
Vernon Glenn Chappell, Jr.	Rich Square
Richard Shermer Davis, Jr.	Lumberton
Levie Marshall Edwards, Jr.	Spring Hope
Waylon Mitchell Jackson	Sanford
Rossie Bailey Jones, Jr.	Zebulon

* Honors ** High Honors ‡In Absentia

**Frank Lawrence Lancaster, Jr. — Rocky Mount
William Grayson Scarbrough — Asheville

Agricultural Engineering

Daniel Wyatte Cope, Jr. — Lexington
William Alexander Davis — Rowland
Jimmy Oakley Hardin — Lumberton
Robert Hege, III — Lexington
Johnny Mack Jones — Snow Hill
Rossie Bailey Jones, Jr. — Zebulon
*Robert Wooten May — Farmville
Steven Darrell Mundy — Conover
Richard Hardy Parker, Jr. — Pollocksville
Thomas Wills Pritchett — Elon College
Clay Hester Vernon, III — Milton

Animal Science

James Franklin Anderson — Goldsboro
John Dale Brooks — Sparta
Robert Milton Coleman — Tabor City
John Thomas German — Boomer
William Waverly Lassiter — Conway
Donald Carroll Parker — Brevard
*Douglas Elmore Taylor — Connelly Springs
*William Ellis Vinson — Charlotte
William Anthony Whitfield — Robersonville

Botany

Harvey William George — Greensboro

Crop Science

Daniel Alexander Allen, Jr. — Roxboro
John Everett Bryant — Franklin, Va.
Harold Dean Coble — Liberty
Thomas Lee Colson — Norwood
Sidney Lawrence Davenport — Pactolus
Bolton William Jones, Jr. — Smithfield
Bryant Cameron Langston, Jr. — Grifton
Frank Boyd Mayfield — Norlina
Thomas Wills Pritchett — Elon College
James Donnie Stephenson — Willow Springs
*Johnny Calvin Wynne — Williamston

Entomology

*Ronald Edwin Stinner — N. Bellmore, N. Y.

* Honors ** High Honors

Food Science

Robert Ernest Burrage — Concord
Joe Cephus Garrell — Tabor City
*Thomas Harold Johnson — Media, Penna.
*Tian Ben Lao — Quezon City, Philippines
Gordon Clark Smith — Westfield, N. J.
James Warren Swain — Columbia
David Alan Weisiger — Fanwood, N. J.

Horticultural Science

Zackie Webster Harrell — Edenton
Richard Edgar Harris — Morehead City
Thomas John Mohan — Raleigh
Richard Eugene Payne — Lexington
William Charles Warlick — Morehead City

Plant Protection

Colin Kelly Batten — Lucama
Bryant Cameron Langston, Jr. — Grifton
**Henry Calvin Newton, Jr. — Wagram
*Lafayette Thompson, Jr. — Lucama

Poultry Science

Charles Gates Fox, Jr. — Cary
Blake Duane Lovette — Millers Creek
Thomas Earl Orr — Candler

Rural Sociology

Mary Lynn Edmondson — Pinetops
Thomas Edward Hallett, III — Nassawadox, Va.
Barry Eugene Horner — Salisbury
‡Clarence Kermit Humphrey, Jr. — Kinston
John Herbert Hyder, Jr. — Lincolnton
Norman Alexander McClure — Alexis
Anne Marie Parker — Raleigh

Soil Science

Daniel Wyatte Cope, Jr. — Lexington
John Paul Lilly — Troy
Steven Darrell Mundy — Conover
*Lafayette Thompson, Jr. — Lucama
Dwight Arnold Towler — Chatham, Va.
Joe Britt Warren, Jr. — Newton Grove

Zoology

John Howard Arnold — Richmond, Va.

*Honors **High Honors ‡In Absentia

*Martin James Barrier — Jonas Ridge
Hilary Flowers Bell — Charlotte
Robert Francis Blackard — Mayodan
*James Dalton Brown — Robersonville
*James La Velle Brown — Richmond, Va.
John Stephen Brown, Jr. — Richmond, Va.
*Arthur Brian Davis — Raleigh
Larry Earl Eshelman — Sinking Springs, Penna.
LaFloyd Hueston Hobbs, Jr. — Raleigh
*Daniel Riley Holder — Raleigh
Edward Lee Holland — Warsaw
Justin Craig Honaman — Glen Ridge, N. J.
Frederick Tryon Horton, Jr. — Raleigh
Harry Lee Liner, III — Waynesville
William McCant — Charlotte
James Rodney McCurry — Candler
*Allan Armstrong Maltbie — Raleigh
*Johnny Baldwin Midgett — Hillsboro
Carole Suddreth Moore — Morganton
**John McLean Nordan — Concord
**Ethel Marie Oliver — Cary
Robert Sidney Page — Rocky Mount
Herbert Ralph Sanborn — Richmond, Va.
**Julian Raleigh Taylor — Raleigh
*William Keith Thompson — Raleigh
John Francis Vance, Jr. — Kernersville

School of Design

BACHELOR OF ARCHITECTURE

Laurin Barker Askew, Jr. — Wilmington
William Alvis Brogden — Sanford
Jack Barney Byars — Oxford
David Huber Carter — Raleigh
*Wesley Milton Coble — Smithfield
Joseph Dixon, III — Tampa, Fla.
Donald Jay Dwore — Schenectady, N. Y.

* Honors ** High Honors

Philip Tsung-Cheng Fei — Kiang Su, China
Rufus Edgar Fitchett, III — Sanford
Stephen Bryant Griffin — Aiken, S. C.
Donald Robert Kann — Baltimore, Md.
Gabriel Krayn — Haifa, Israel
Anne Jeanette Lester — Raleigh
James Marshall Mauney — Wilmington
*Morris Edward Parker — Murfreesboro, Tenn.
Arthur Wayland Plaster — Morganton
Robert Wharton Rankin — Arlington, Va.
Conrad David Schaub — Painesville, Ohio
Robert Silverman — Union, N. J.
William Alfred Stancil — Rocky Mount
Ronald Wesley Thompson — Lumberton
Carey Yates Tilson, Jr. — Chapel Hill
Wallace Gerald Venable — Raleigh
Edward Harold Williams, Jr. — Raleigh
David Sol Zuckerman — Union, N. J

BACHELOR OF LANDSCAPE ARCHITECTURE

John Robert Beaman, Jr. — Swannanoa
James Brooks Breeden, Jr. — Fayetteville
Baxter Wayne Coulter — Raleigh
Hal Laney Price — Pineville

BACHELOR OF PRODUCT DESIGN

Lawrence McNeill Cotton — Roanoke, Va.
Thomas Eastwood Culbreth — Southern Pines
George Samuel Seegers, Jr. — Charlotte

School of Education

BACHELOR OF SCIENCE IN EDUCATION

Agricultural Education

William Howard Adams, Jr. — Maiden
Earl Franklin Brinkley — Teachey
James Bryan Brooks — Bath
Luther Warren Carver — Hudson
Billy Joe Chapman — Kannapolis
David Haywood Creech — Kenly
Richard Wayne Daniel — Coats
James Alton Daughtry — Conway

* Honors

*Willard Richardson Dean, Jr. — Wendell
Roy Winston Fornes — Greenville
Lewis Conrad Forrest, Jr. — Newport
Robert Lamar Hardie — Clarendon
Milton Glenn Ingram — Princeton
Louis Andrew Leimone — Burgaw
*Paul Neal Lineberger — Dallas
*James Wingate McNeill, Jr. — Knightdale
Paul Bert Roberson — Williamston
Norman Harold Rose — Princeton
James Eugene Shue — Salisbury
Hovis Julian Smith — Wingate
Allen Walter Vinson — Swansboro
Robert Lee Willis, Jr. — Lawndale

Industrial Arts Education

Rosario Salvatore Amato — Easton, Penna.
Don Wesley Dyer — Charlotte
Gary Allen Kanoy — Thomasville
Larry Grant Martin — Lasker
Jack Lawrence Sharp — Greensboro

Industrial Education

Edgar Jacob Derr — Asheboro

Mathematics Education

Louis Baker Alexander — Raleigh
Richard Herbert Barnwell — Hendersonville
*Robert Edward Cole — Greensboro
James Connell Etheridge — Bethel
Robert Newland Ford — Kure Beach
Kenneth Earl Freeman — Concord
*James Terry Lowder — Burlington
David Lynn McCuen — Swannanoa
Donald Reid McGinnis — Gastonia
Albert John Mauro, Jr. — Verona, Penna.
**Gene Beauregard Mercer — Pink Hill
Malcolm Brown Morrison — Rowland
Wendell McCullen Murray, Jr. — Greensboro
Robert Lynnwood Pugh — West Jefferson

Science Education

Norman Gordon Blake, Jr. — Raleigh
Harold Vernon Tate, Jr. — Farmville, Va.

BACHELOR OF SCIENCE IN INDUSTRIAL ARTS

Bernard Franklin Armstrong — Charlotte
Joseph Carlton Arnold — Creedmoor

* Honors ** High Honors

‡John Logan Barbee — Yaupon Beach
Terry Dough Beacham — Kitty Hawk
*Joseph Baker Boyce, Jr. — Manteo
Milton Ray Britt — Goldsboro
Thomas Alva Butler — Macon, Ga.
Marshall Benton Cain — Garner
Richard Purvis Ferree — Polkton
Frank Wilson Futrell, Jr. — Statesville
Jeffrey Vance Goodman — Salisbury
Silas Ervin Heath — Pink Hill
Michael Lee Hill — Raleigh
John Christopher Irvin, III — Salem, Va.
Grady Daniel Knott — Clayton
Virgil Conrad Leonard, Jr. — Lexington
Larry Brown Lovvorn — Raleigh
Howard Wesley McAllister, Jr. — Aurora, Ill.
Carroll Jennings McClellan, III — Summerfield, Fla.
Ernest Jackson Hutchins Mann — Raleigh
Clyde Lemuel Odom — Conway
Donald Medford Patterson — Wilmington
Donald Sharpe Pickard — Winston-Salem
Frederick William Pinkston, Jr. — Salisbury
Charles Monroe Ridoutt — Garner
Alan David Seiferheld — New London, Conn.
Joseph Edwin Stephens — Wilmington, Del.
Julius Delane Suggs — Elizabethtown
William DeSombre Tepper — Flagtown, N. J.
Kenneth Wayne Troutman — Charlotte
Ronald Larry Whaley — Garner

BACHELOR OF SCIENCE IN RECREATION AND PARK ADMINISTRATION

**Imogene Coriell Chamberlin — Raleigh
Joseph Michael DelloStritto — Swissvale, Penna.
Robert Prince Hudson, Jr. — Raleigh
Shelby Harris Mansfield — Camden
Lawrence Ray Mays — Sandy Ridge
Leslie Gregory Robinson — St. Albans, W. Va.
Ronald Joseph Skosnik — McKees Rocks, Penna.
Silas Jones Snow, Jr. — Rocky Mount
Samuel Joseph Sorce — Passaic, N. J.
Thomas Hamilton Stewart — Henderson
James Thomas Swann — Morehead City
Clyde Wylie Wrenn — Chester, S. C.

*Honors **High Honors ‡In Absentia

School of Engineering

BACHELOR OF SCIENCE IN AEROSPACE ENGINEERING

John Birce Baker	Rocky Mount
Jerold Glen Barger	Hickory
Thomas Steven Black	Lexington
William Michael Branch	Mooresville
Donald Ray Cagle	Kannapolis
John Harry Covington	Gastonia
Graham Allen Darnell	Minatare, Neb.
William Hale Duncan, Jr.	Burlington
Joseph Linwood Dunn	Efland
James Wayne Edwards	Stanley
Jonathan Abraham Fishbein	Brooklyn, N. Y.
Jerry Wayne Gray	Winston-Salem
William Wallace Griffin, Jr.	Wilson
James Richard Huntley, Jr.	Monroe
David Jackson Ivey	Montgomery, Ala
William Gary Jackson	Arden
Albert Gordon Johnson	Conover
*Gilbert Ronald Jones	Sanford
*Bruce Clyde Jordan, Jr.	Henderson
Michael Ray Kennedy	Kinston
Jerry Eugene Long	High Point
**John William McCulloch	Greensboro
*David Sanders Miller	Concord
Terry Kermit Mitchem	Lincolnton
Donald Gene Peele	Stokes
**Hilton Boyd Perry	Greensboro
Lloyd Thomas Perry, Jr.	Merry Hill
Richard Wayne Revels	Charlotte
Morton Albert Serrell, Jr.	Charlotte
*George Harley Smathers	Canton
James Lee Sossamon	Bryson City
**David Ray Stone	Stony Point
William Thomas Taylor	Wilmington
Opie Woodrow White, Jr.	Elkin
Richard Stanley Williams	Myrtle Beach, S. C.
Artie Zaras	Rockingham

BACHELOR OF SCIENCE IN CERAMIC ENGINEERING

Herbert Michael Blankenship	Horse Shoe
Gerald Thomas Lester, Jr.	Kinston
*George Leslie Morelock, III	Memphis, Tenn.
Philip Owen Ransone	Hampton, Va.

* Honors ** High Honors

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

*Marshall Stuart Blanton	Shelby
**Norvin Aaron Clontz	Glen Alphine
*Robert Herring Crutchfield	Kannapolis
*James Martin Davis	Rowland
*Timothy McLean Davis	Maxton
Wayne Thomas Day	Roxboro
Eric Ray Edgerton, Jr.	Kenly
Horace Duane Griffin	Rocky Mount
Henry Ainslie Hair, Jr.	Mount Airy
*Charles Jakie Haulk	Forest City
Curtis Wayne Honeycutt	Bessemer City
Jerry Dal Huffman	Maiden
*Raebourne Brown Hurst, Jr.	Winston-Salem
*Michael Lee Jones	Fayetteville
*William King	Florence, S. C.
Julio Roberto Lago	Miami, Fla.
Hiram Howard Lee	Pink Hill
Clarence Robert Lloyd	Durham
**Kenneth Norwood McKelvey	Raleigh
George Solomon Mayo	Greenville
‡Ambrish Vipinbhai Munim	Bombay, India
Warren Trent Piver	Rochester, N. Y.
*Ross Rogers Ruland	Raleigh
John Preston Shillinglaw, Jr.	Rock Hill, S. C.
**Joseph Vaden Smith	Mount Airy
*Allen Kyle Tothill	Winston-Salem
Robert Wesley Voncannon	High Point
Robert Henry Wilkinson	Mooresville

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

**James Ashley Aberson, Jr.	Charlotte
Larry Ralph Absher	Scottville
*Moultrie Moore Alexander, Jr.	Decatur, Ga.
Eugene Walker Armistead, Jr.	Asheville
*Raymond Richard Avent, Jr.	Newport News, Va.
James Elmore Barnes	Raleigh
Frederick Vaughn Beeson, Jr.	Monroe
Robert Luther Boisky	Fort Bragg
Bryant Terry Brothers	Elizabeth City
Danny Edward Burwell, Jr.	Winston-Salem
Ronald Sidney Butler	Forest City
Raymond Howard Cathey	Charlotte
George Wilkes Chapman, Jr.	Charlotte
Albert Thomas Clayton	Oxford
*Roy Lee Dean	Oxford
Andre Redwine Duval	Waxhaw
George Holloman Ellinwood	Greensboro
Oscar Leon Everett, III	Virginia Beach, Va.
John Wesley Flora	Portsmouth, Va.
Carvie Thomas Freeman	Charlotte
James Fuel Fulton, III	Greensboro
John David Grady, III	Goldsboro
Melvin Clifton Griffin	Spring Hope

*Honors **High Honors ‡In Absentia

William Richard Hall ..... Sylva
Wade Everette Hoke ..... Statesville
William Lewell Huff ..... Roxboro
James Thomas Jarrett ..... Asheville
Berry George Jenkins, Jr. ..... Wilmington
Vann Sylvanus Joines, Jr. ..... Reidsville
Ramey Kemp ..... Mocksville
Arthur Louis Kennedy ..... Kinston
Douglas Toney Lanier ..... Wilmington
Ronald Charles Lineberger ..... Dallas
Keith George McBride ..... Grove City, Penna.
Hal Swindell McGee ..... Swan Quarter
Howard Franklin McKnight, Jr. ..... Williamston
William Wade Mahler ..... Grifton
Ernest Franklin Mallard ..... Wilson
William Lawrence Mickey ..... High Point
*Walter Warren Miller, Jr. ..... Idaho Falls, Idaho
Michael McDowell Mottern ..... Morehead City
Stephen Fair Nelson ..... Leaksville
Byron John O'Quinn ..... Lillington
Joe Thomas Osborne ..... Laurel Springs
William Sidney Riddick, Jr. ..... Elizabeth City
David Livingston Riley ..... Charlotte
Thomas Franklin Rogers, II ..... Charlotte
Thomas Stockard Routh ..... Greensboro
Jerry Lee Ruppe ..... Cliffside
George Richard Shirley, Jr. ..... Greensboro
James Stanly Smith ..... Arlington, Va.
*Richard Slaughter Taylor ..... Goldsboro
Jerry Wayne Thompson ..... Graham
John Chauncey Wadsworth ..... Magnolia
Michael Neil Wagoner ..... Greensboro
Fred Roger Watson ..... Lenoir
Larry Turner Williams ..... Gastonia
Charles Thomas Wilson, Jr. ..... Durham
William Howard Wood, Jr. ..... Wilmington
Teddy Jerome Wright ..... Rutherfordton
Andrew Yasinsac, Jr. ..... Sparta
*James Lee Zimmerman, Jr. ..... Lexington

BACHELOR OF SCIENCE IN CIVIL ENGINEERING, CONSTRUCTION OPTION

James Henry Anderson ..... Arden
George Franklin Blizzard, Jr. ..... Navassa
Maurice Franklin Canady, Jr. ..... Wilmington
Frederick Holmes Cron ..... Bowie, Md.
Dennis Neil Danner ..... Hickory
Henry Lee Davis ..... Winston-Salem
William Perry Grant ..... Winston-Salem
Joe Allan Hall ..... Sylva
Colon Eli Hine, Jr. ..... Winston-Salem
Donald Wayne Howard ..... Durham
James Ross Lathan ..... Greensboro
Claude Douglas Madison, Jr. ..... Statesville
Richard Horton Moore ..... Spring Lake
Mahmood Motamen ..... Tehran, Iran

* Honors

James Fredrick Murray, II ..... Wilmington
Melvin Nelson, Jr. ..... Sanford
Michael Reid Norris ..... Wilmington
Johnny Ray Ollis ..... Morganton
David Thomas Rogers ..... Brightwaters, N. Y.
James Hoyd Routh ..... Greensboro
David Clarence Sloan ..... Greensboro
Thomas David Smitherman ..... East Bend
David Lee Stout ..... Durham
John William Tarleton ..... Monroe
William Ernest Tulluck, Jr. ..... Orangeburg, S. C.
James Donald Wilson ..... Statesville
Henry Blanchard Wyche, Jr. ..... Hallsboro

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

Robert Stephen Adams ..... Leaksville
Charles Oren Allen ..... Kings Mountain
Donald James Almond ..... Shelby
*Jasper Leonard Armstrong, Jr. ..... Gastonia
*William Wyatt Austin, III ..... Raleigh
*Richard Haywood Bailey ..... Woodsdale
Leo Ivan Barker, Jr. ..... Gastonia
Cleatus Barron Bartlett, Jr. ..... Charlotte
*Wayland Kenneth Bell ..... Faison
James Birven Blanchard ..... Turkey
Donald Eugene Boozer ..... Greensboro
*Jack Roger Bridges ..... Raleigh
**Jerry Ralph Briggs ..... Mars Hill
**Sandy Dexter Brooks ..... Pembroke
Albin Pafford Bukowick ..... Westfield, Mass.
Charles Ryan Bumgarner ..... Wilkesboro
Glenn Douglas Carver ..... Swepsonville
Robert Lee Chew, III ..... Winston-Salem
William Lowman Collins ..... Winston-Salem
**Robert Warren Downing ..... Winston-Salem
William Woollcott Ellington, Jr. ..... Charlotte
*Phillip Russell Epley ..... Morganton
*James Seawright Florence, Jr. ..... Raleigh
Kent Bernard Foster ..... Concord
Harold William Fowler ..... Bryson City
Nelson Eugene Fulbright ..... Newton
*Eng Tsan Gaw ..... Manila, Philippines
*Leon Jennings Gentry ..... Madison
John McNatt Gillis, Jr. ..... Fayetteville
Richard Conrad Gribble ..... Kannapolis
Kenneth Hansley ..... Wilmington
Samuel Douglas Harmon ..... Hickory
Cecil Alvin Harrison ..... Baton Rouge, La.
Gregory George Hartenstein ..... Tiffin, Ohio
**Larry Joseph Hash ..... Monroe
Franklin Lewis Hawks ..... Mount Airy
*Michael Ney Hayes ..... Massillon, Ohio
**Lowell Hibbard ..... Manchester, Ky.
Dale Fidel Hicks ..... Ozona, Texas
Walter Wells Hill ..... Murfreesboro
David Owen Hinton ..... Gibsonville
*Stuart Boyce Holoman ..... Raleigh

*Honors **High Honors

George Leon Hooks, III	Rocky Mount
**Robert Gene Howell	Boone
Charles David Hughes	Ash
William Edward Hulse	Somerville, Mass.
William Arthur Jenkins, III	Charlotte
Franklin Carlyle Joyner, Jr.	Clinton
Russell Lewis Keen	Four Oaks
**John Austin Kelly, Jr.	Jonesville
Andrew Harris Kilpatrick	Greenville
William Felton Knight	Kenly
James Kenneth Kroeger	Raleigh
Rupert Carroll Lail, Jr.	Hickory
Edward Charles Lee, Jr.	Elizabeth City
James Warren Lineberger	Stanley
Davis Bagley Lumpkin	Pittsburgh, Penna.
Arthur Richard McDonald, Jr.	China Grove
William Ray Mackie	Catawba
Harry Gus Maheras	Gastonia
John Wesley Miller	Clarkton
*Theodore Clifford Miller, III	Winston-Salem
Richard Clark Mills	Taylorsville
David Fleming Milton	Lillington
*John Raymond Monroe	Greensboro
David Carroll Moore	Hudson
Graham Hartwell Mosely	Raleigh
Rolf Henk Nijhuis	Jamestown
Ralph Dale Parsons	Lenoir
*Richard Carlton Paschall, Jr.	Jacksonville
**James Erving Paul, Jr.	New Bern
Norman Taylor Payne, Jr.	Charlotte
Donald Davis Perry, III	Hamlet
William Eugene Powell	Greensboro
*Willard George Preussel, Jr.	Winston-Salem
Roy Herman Propst	Spencer
Charles Douglas Pugh	Burlington
Calix Lee Reneau	West Palm Beach, Fla.
Joseph Harold Renier	Greensboro
Larry Alden Roark	Johnson City, Tenn.
John Hughes Roberts, Jr.	Chase City, Va.
James Campbell Sanders	Badin
Jay Keitt Sawyer	Vanceboro
Walter Steven Sechrest	Lexington
*Gordon Eric Shuford, Jr.	Hickory
Darrell Wilburn Sigmon	Hickory
*James Richard Simon	Rosemont, W. Va.
**James Alan Steppe	Valdese
Robert Dean Stolt	Cadillac, Mich.
James Everette Stoner, Jr.	Concord
Albert Gray Sullivan	Hickory
*James Davis Terrell	Morehead City
John David Turner	Albany, Calif.
*Michael Thomas Vanecek	Pasadena, Texas
*John Gilbert Vick	Kinston
*Brady Holton Warner, Jr.	Lexington
*Ralph Mayo Warren	Chapel Hill
Gary Carl Watford	Thomasville

*Honors **High Honors

Abdul Shukoor Roshida
Kabul, Pakistan

Marvin Eugene Weant ..... Rockwell
Kenneth Glenn White ..... South Mills
Carlos Robert Williams, Jr. ..... Fayetteville
John Ralph Williams ..... Tryon
Marvin Douglas Williams ..... Kannapolis
John Wagner Yarbrough ..... Winston-Salem
*Daniel LeRoy Young ..... Jacksonville, Fla.

BACHELOR OF SCIENCE IN FURNITURE MANUFACTURING AND MANAGEMENT

William Ramsay Abernethy ..... Hickory
William Melvin Bunch, Jr. ..... Elizabeth City
Hugh Abbott Burton ..... Jacksonville
*William Morse Duncan, Jr. ..... Wilkesboro
*Sam Pierce Harrell, Jr. ..... Wadesboro
David Arthur Holder ..... Raleigh
Andrew Roy Jackson, Jr. ..... Lillington
White Hall Morrison, III ..... Nashville, Tenn.
Thomas Deal Pearson ..... Wilkesboro
John Wesley Purdie, Jr. ..... Davidson
Birger Kristian Wergeland Rasmussen, Jr. ..... Raleigh
John Erwin Sloop ..... Statesville
Charles Hubert Thomas, Jr. ..... Marion

Dennis Eugene Hurley - Hickory

BACHELOR OF SCIENCE IN GEOLOGICAL ENGINEERING

William Coit Edison, Jr. ..... Atlanta, Ga.
Michael Wilburn Phillips ..... Elon College
Richard Anthony Young ..... Princeton

BACHELOR OF SCIENCE IN INDUSTRIAL ENGINEERING

Benito Artinano ..... San Jose, Costa Rica
Richard James Babcock ..... Raleigh
Stanford Raynold Brookshire, Jr. ..... Charlotte
**William James Burgess ..... Staley
Richard Edward Byrd, Jr. ..... Bunnlevel
William Clyde Clontz ..... Asheville
*Joseph Coy Eller ..... Purlear
*Ernest Emory Enscore, Jr. ..... Hampton, Va.
David Monroe Fisher ..... Thomasville
Emmett Hilton Goodrich, Jr. ..... Henderson
Joseph Armfield Leinster, Jr. ..... Raleigh
*Ernest William Moore, Jr. ..... Wilmington
*Edward Milton Pyatte ..... Lenoir
John Curtis Roy, Jr. ..... Marietta, Ga.
Douglas Robert Sanford ..... Cary
Randall Wheless Spencer ..... Madison
Stewart McBryde Stoudemire ..... Lincolnton

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

David Stuart Allen ..... Greensboro
Richard Charles Allen ..... Asheville
*William Maynard Angley, Jr. ..... Lenoir

*Honors **High Honors

Benjamin David Archer	Charlotte
Ray Winston Barnes	Rocky Mount
George Oates Batton	Roanoke Rapids
*Michael Alston Boles	Jonesville
Bernard Philip Bowling, III	Durham
David Thomas Boyd	Washington
Robert Otto Brandt, Jr.	Riegelwood
Ray Briley Broughton	Durham
Frederick Edgar Bryson	Bryson City
Matthew Love Byrne, Jr.	Rocky Mount
Terry Kerns Cagle	Asheboro
Ronald Marion Campbell	Spindale
John Pressly Carson	Statesville
William Robert Cartwright	Elizabeth City
Jerry McLain Cecil	High Point
John Oman Christopher, Jr.	Greensboro
*William Keith Clapp, Jr.	Miami, Fla.
Miles Winfred Davis, Jr.	Kitty Hawk
Samuel John Duckworth	Matthews
*Stanley Eugene Dunn, Jr.	Miami, Fla.
Howard Edwin Earley	Hudson
James Louis Etchells	Raleigh
*Lathan Howard Farless	Colerain
*James Sherwood Forrest	Kings Mountain
John Flay Gardner, Jr.	Shelby
Roger Herman Graves	Burlington
*Larry Lee Greene	Locust
David Ezra Gurley, Jr.	Goldsboro
Richard Hunter Harris	Charlotte
Carl Dewitt Hemric, Jr.	Dobson
*David Glenn Hill	Marshville
Christopher Lloyd Hope, Jr.	Gastonia
James Raeford Ingram	Goldsboro
Joseph Jackson Jenkins, Jr.	Matthews
Charles Bernard Jones, Jr.	Wilson
*David Douglas Jones, Jr.	Salisbury
*Jackie Glenn Kepley	Lexington
**Ralph Norman McGill	Charlotte
Donald Fisher Maner	New London
Joseph Talay Metzler	York, Penna.
*David King Miller	Baltimore, Md.
Glenn Edward Miller	Phillipsburg, N. J.
Kenneth Evans Mills	Greensboro
Alfred Wesley Moss	Charlotte
William Henry Nau	Hickory
*Ralph Arrelius Nelson, Jr.	Winston-Salem
Harold Dean Norman	Charlotte
Ronald Wayne Oates	Hendersonville
James Davis Phillips	Winston-Salem
William Gordon Poole	Taylorsville
William Thurman Pope	Durham
Victor McCoy Respess	Greenville
Edward Hamby Robbins	New Bern
Johnny Melvin Simmons	Burlington
*Zan Provost Smith	Chapel Hill
Theodore Perry Smyre	Conover

*Honors **High Honors

John David Summerlin, Jr. - Kinston

*Stanley Douglas Stough — Woodleaf
Thomas Sullivan — Hapeville, Ga.
Marshall Ray Terry — Albemarle
Marvin William Thomson — Winston-Salem
Guy Jackson Timberlake, Jr. — Timberlake
**Joel Edwin Walker — Shelby
Michael Wiley Wall — Henrietta
Leonard Walsh — Roxboro
Warren Wade Way, Jr. — Charlotte
George Ormand White, II — Lillington
William Carroll Widenhouse — Morganton
John Winfield Wilfong — Claremont
Ricky Jeyrl Wilkinson — Newton
Calvin Kenneth Willard — Draper
*Fred Swindell Willis, Jr. — Morehead City
Jack Wilcox Wilson, Jr. — Gastonia
Glenwood Woody Wooten — Fountain
David Linton Wray — Shelby
*Kenneth Eugene Wright — Hickory
Barry George Zepke — Haddonfield, N. J.

BACHELOR OF SCIENCE IN METALLURGICAL ENGINEERING

John Battle Ballance — Four Oaks
Subhash Panalal Dalal — Bombay, India
*Reuben Albert Haase — Greensboro
William Fredrick Sharp, Jr. — Greensboro
Byron Larry Shives — Salisbury
Walter Tilford Smith, Jr. — Newport News, Va.
Lewis Andrew Trumbo — Raleigh
Deal Prince Watkins, Jr. — Raleigh

BACHELOR OF SCIENCE IN NUCLEAR ENGINEERING

Norman John Andrews — Raleigh
John Reynolds Baucom, Jr. — Wilmington
Joseph Whitehurst Caveness — Mount Olive
William Franklin Daughtridge, Jr. — Rocky Mount
David Paul Dobbins — Shelby
*Eugene Octavius Eagle, Jr. — Greensboro
Richard Nathaniel Edwards, Jr. — Raleigh
Thomas Theodore Fallas — Clarks Summit, Penna.
Charles Daniel Forney, III — Lawndale
*Robert Gilmer Foster, Jr. — Kinston
Ralph Springer Gross — Winston-Salem
*Marvin Jonathan Haire — Jacksonville
Charles Lee Holland — Shelby
*Thomas Richard Horton — Charlotte
Steven Butler Humbert — Greenville
*Stephen Andrew Johnston — Concord
**Charles Lee Kling — Kinston
Louis Howard Martin — Murphy
Richard Ellis Martin — Raleigh
Barry Steve Mullinax — Hendersonville
Raymond Wilson Parker, Jr. — Rocky Mount

*Honors **High Honors

Charles Edmond Hyatt - Raleigh

*Robert Knighton Stampley	Portsmouth, Va.
William Matlock Stocks	Hookerton
Richard Lee Summers	Toledo, Ohio
Robert Earl Surratt	Greensboro
*Larry Ronald White	Randleman
Stephen Leon Williams	Kannapolis

School of Forestry

BACHELOR OF SCIENCE IN FOREST MANAGEMENT

Paul Jerry Bonardi	Sanford
*William Barr Brooks	Richmond, Va.
Phillip George Clegg	Durham
Philip Griffin Connell	Charlotte
Shafter Edward Drinkard	Raleigh
Charles Joseph Duckworth	Brevard
William Charles Duffy, Jr.	Franklin, Va.
*Harry Todd Fisher	Candor
**Jimmy Douglas Gregory	Angier
Glen Stuart Harris	Wakefield, Va.
Thomas Gardner Harris, Jr.	Roanoke Rapids
*Marvin Bobb Hula	Charles City, Va.
*John Ferman Irby, Jr.	Bon Air, Va.
Jonathan Jeffries	Peoria, Ill.
Dock Edgar Johnson	Randleman
Jack Claude King	Providence Forge, Va.
**Samuel Buchanan Land, Jr.	South Hill, Va.
James Robert McGraw	Winston-Salem
George Henry Maxwell, Jr.	Elizabethton, Tenn.
Donald Reed Page	Chattanooga, Tenn.
Douglas Ray Phillips	West Jefferson
Warren Ernest Taylor, Jr.	Chesapeake, Va.
Donald Lee Torchia	Utica, N. Y.
Fayette Conquest Wiatt	Gloucester, Va.

BACHELOR OF SCIENCE IN PULP AND PAPER TECHNOLOGY

Laurice Gaillard Altman, Jr.	Georgetown, S. C.
David Emerson Augspurger	Hamilton, Ohio
*Bennett Ray Baird	Raleigh

*Honors **High Honors

William Edward Bradford	Mount Airy
*Ernest Calvin Clark, Jr.	Stanley
Virgil Forrest Crabtree, III	Camden, Ark.
Edward Percy Guerard, Jr.	Georgetown, S. C.
Robert Clarke Harrison	Williamsburg, Va.
*Richard Howard Holley	Arlington, Va.
George Richard Kall, Jr.	Pittsburgh, Penna.
Mun Tai Li	Hong Kong
John Stanley Pritchard	West Point, Va.
*Harry Thomas Sanders, Jr.	Southport
Thomas Wayne Sawyer	Bear Grass
Joe Ben Seagle	Morganton
Yajna Valk Sharma	Punjab, India
Abu Bakr Siddique	Comilla, Pakistan

BACHELOR OF SCIENCE IN WOOD TECHNOLOGY

Alvie Roy Marcellus	Schaghticoke, N. Y.

School of Liberal Arts

BACHELOR OF ARTS

Phillip Ray Adams	Raleigh
Peggy Nash Baker	Raleigh
Robert Herring Boyd	Raleigh
*Philander Dean Chase	Raleigh
James Edward Cline	Raleigh
Sandra Barden Connelly	Red Springs
*Allen Cordell Donohue	Fayetteville
Arthur Edwin Dumont, Jr.	Charlotte
Cleta Eileen Dunaway	Raleigh
Barbara Bishop Ellisberg	Raleigh
Virginia Ethel Farnell	Jacksonville
**Joan Copeland French	Nashville, Tenn.
Joe Cephus Garrell	Tabor City
**Irene Jones Gaskins	Charlotte
Paul Tudor Gray, Jr.	Raleigh

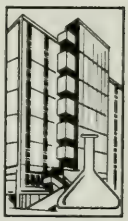
*Honors **High Honors

Preston Elwood Hodges, Jr.	Raleigh
Darrow Ransdell Johnson	Raleigh
Larry Allen Knowles	Bolivia
Jasper Whitfield Lee, Jr.	Wilson
*Charles Ervin Lewis	Raleigh
*Stephanie Ecker Moss	Los Angeles, Calif.
John Franklin O'Brien	Rockingham
Calvin Cecil Oliver, Jr.	Fuquay-Varina
Chester Bernard Penninger, Jr.	Charlotte
Glenn Garrison Rhodes, Jr.	Matthews
*Michael Smith Scofield	Princeton, N. J.
Harold Dwight Smith, Jr.	Albemarle
John Hsintseng Soo	Hong Kong
Julia Jean Stanaland	Elizabeth City
Jack Wilson Stokes, Jr.	Kinston
John Henry Vincell, III	Raleigh
‡Remsen Sheldon Voorhis, II	Chapel Hill
Judith Eva Wadford	Raleigh
Glenn Thomas Warren	Clearwater, Fla.

BACHELOR OF SCIENCE

Thomas Edward Bailey	Raleigh
**Carolyn Lindh Ball	Raleigh
John Charles Cobb	Raleigh
Cora Alice Kemp	Louisburg
William Sibley Law, II	Fayetteville
Matthew Brown Long, Jr.	Raleigh
William Ernest Marshall, Jr.	Raleigh
Irvin Burchard Tucker, III	Raleigh
Clayton Loris Watson	Lenoir

School of Physical Sciences and Applied Mathematics



BACHELOR OF SCIENCE IN APPLIED MATHEMATICS

John William Allen	Burlington
Robert Vance Ammon	Statesville
Robert Eugene Baker	Kannapolis
Joseph Livingston Bridger	Bladenboro
Charles Albert Chapman, III	Raleigh

*Honors **High Honors ‡In Absentia

**John Steele Culbertson, Jr.	Silver Spring, Md.
George Robert Dobbs	Asheville
*Stephen Michael Fulp	Kernersville
**Herbert James Goldston, Jr.	Sanford
James Howard Goodnight	Wilmington
Barry Santee Griffin	Indianapolis, Ind.
**William Carlyle Hall, Jr.	Plymouth
*Michael Ney Hayes	Massillon, Ohio
Ernest Victor Jones, Jr.	Williamston
*Daniel Wood Krider	Statesville
Yek Ben L. Lao	Quezon City, Philippines
*Jansen Bailey Lasley	Lancaster, S. C.
*Gloria Jean Lawrence	Asheville
John Hunter McCoy	Charlotte
*Mitchell Moore	Cordova
*Charles Edward Morris	Raleigh
Larry O'Neil Nichols	Cramerton
Wade Lewis Ogburn	Roanoke Rapids
Robert Clarendon Powell, Jr.	Asheville
Thomas Martin Rhodes	Leaksville
**William Gale Rhodes	Leaksville
Samuel Gilmore Saunders, Jr.	Waynesboro, Va.
‡*Herman Frank Senter	Charlotte
James Ernest Smith	Shelby
Ronald Wayne Steele	Burlington
*Alan Brooke Stice	Raleigh
*Edward Keith Tester	Blowing Rock
Ralph Thomas Wallace	Cameron
*Robert Earl Wallace	Opa Locka, Fla.
**Charles Newton Winton	Raleigh
David Whitson Workman	Thomasville

BACHELOR OF SCIENCE IN CHEMISTRY

*Richard Harlan Brant	Raleigh
Harry Payton DeLong	Wilson
Michael Ronald Foust	Franklinville
John Charles Livingston	Charlotte
**Ethel Marie Oliver	Cary
*Robert Glenn Stoner, Jr.	Richfield

BACHELOR OF SCIENCE IN EXPERIMENTAL STATISTICS

Larry Allan Hoover	Raleigh
Reef Challance Ivey, II	Lumberton
Thomas Lenoir Johnson	Hendersonville
Michael Stanley McLeod	High Point
Robert Arlington Wiltshire, II	Chevy Chase, Md.

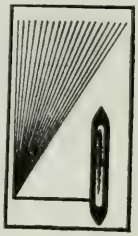
BACHELOR OF SCIENCE IN PHYSICS

*William Carridine Collins	Fayetteville
**Edwin Lane Fasanella	Roaring River

*Honors **High Honors ‡In Absentia

Doily Earl Fulcher ..... Stacy
*Anatole Petrovich Grishin ..... Sanford
Charles Ned Harward ..... Raleigh
Rudolf Paul Wiegand, Jr. ..... Charlotte
Mariwynne Elizabeth Winton ..... Rochester, Mich.
Frank Conder Ziglar, Jr. ..... Raleigh

School of Textiles



BACHELOR OF SCIENCE IN TEXTILE CHEMISTRY

Ronney Gray Belton ..... Winston-Salem
Joseph Grant Blair ..... Jamestown
Stephen Hill Dobbins ..... Cliffside
**‡Joseph Pierre Fortier ..... Quebec, Canada
*James Riley Groome ..... Greensboro
*William Francis Hunter ..... Clarksville, Va.
Charlie McCoy Killian, Jr. ..... Mount Holly
Edgar William Lefler, III ..... Albemarle
*Denis David Marcotte ..... Montreal, Canada
Ted Gorden Norris ..... Ayden
*Haci Ali Oner ..... Erzurum, Turkey
**Henry Walter Somers, Jr. ..... Burlington
Joe Frank Spoon ..... Burlington
*Grant Herbert Warner ..... Wilmington, Del.
Kenneth Sheridan Weaver ..... Mebane

BACHELOR OF SCIENCE IN TEXTILE TECHNOLOGY

Thomas Burwell Baucom ..... Cary
Paul Steven Beamon ..... Concord
Denis Beaudoin ..... Quebec, Canada
Charles Edward Bowers ..... Albemarle
Hugh Johnston Boyer ..... Elizabeth City
James Blythe Brown ..... Goldsboro
**William James Burgess ..... Staley
William Samuel Burns ..... Gastonia
Richard Edward Byrd, Jr. ..... Bunnlevel
Eugene Yeu-zen Cheng ..... Hong Kong
Teofilo Enrique Chirinos ..... Punto Fijo, Venezuela
Chester Wash Cooke, Jr. ..... Belmont

*Honors **High Honors ‡In Absentia

Walter Thompson Cox, Jr.	Raleigh
David Wayne Craft	Cherryville
James Patrick Cruikshank	Asheville
Robert Lee Daniel, Jr.	Henderson
Rodgers Edward Dayvault, Jr.	Lexington
Stephen Barrett Duerk	Baldwin, N. Y.
Michael Glenn Farrell	Graham
*Moshe Feldman	Lima, Peru
Henry Norfleet Felton, III	Greenville
Jack Louis Hardy, Jr.	Charlotte
David Bennett Hill, Jr.	Wadesboro
*William King Howle	Burlington
Gareth Lynwood Johnson	Siler City
*George Robert Johnson	Wilmington
Carleton Franklin Kingson	New York, N. Y.
*Joe Thomas Koontz	Salisbury
**Steve Kulawic	Ontario, Canada
Jerry David Lee	Coats
James Reid Lisk	Albemarle
Harvey Dennis Lowman	Connelly Springs
Stephen Edward McCauley	Old Fort
Jerry Roger McNeill	Asheboro
‡Roger Thomas Mandeville	Quebec, Canada
Sterling Manley Mann	Newport
*Wayne Hugh Marshall	Colfax
James Theodore Mills	Shelby
James Thomas Morrison, Jr.	Asheville
Talmage Edward Nowell, Jr.	Raleigh
‡Richard Andre Parent	Quebec, Canada
‡Robert Larry Paschall	Durham
Maurice Richard Pepin	Quebec, Canada
*Ramanathapuram Sadasivan Ramachandran	Bombay, India
Blake Arnold Ratliff, Jr.	Wadesboro
Carl Moore Satterwhite, Jr.	Salisbury
Edwin Robinson Scott, Jr.	Raleigh
*Mark Hanna Shanker	Woodmere, N. Y.
Johnny Dale Shelton	Albemarle
*Darrell Conrad Steagall	Leaksville
*Jimmy Ben Summitt	Cherryville
James Gray Swaim	Elkin
Ralph Wayne Underhill	Raleigh
Martin Kellogg White	Manteo
*William Edward Whitley	Rockingham

Professional Degrees

Civil Engineer, Soil Mechanics and Foundation Option

Carey Franklin York	Pinetops

Civil Engineer, Structural Option

William James Renton	Pittsburgh, Penna.

Electrical Engineer

Albin Pafford Bukowick	Westfield, Mass.

*Honors **High Honors ‡In Absentia

Cecil Alvin Harrison ..... Baton Rouge, La.
Gregory George Hartenstein ..... Tiffin, Ohio
‡William Thomas Jefferson ..... Chapel Hill
John David Turner ..... Albany, Calif.

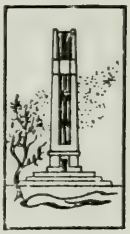
Geological Engineer

Meng Kruy Ung ..... Prey Veng, Cambodia

Industrial Engineer

David William Metcalf ..... Winston-Salem

Master's Degrees



MASTER OF AGRICULTURE

‡Eugene Harry Boyles ..... Gainesville, Ga.
Joe Mason Kenyon, Jr. ..... Hillsboro
‡Robert Clellan Ward ..... Lexington, Ky.
‡Renato Zeppilli ..... Lima, Peru

MASTER OF APPLIED MATHEMATICS

‡Wiley Bynum Crook ..... Asheville
Jasper William Dunn, III ..... Memphis, Tenn.
Robert Neal Hinson ..... Wadesboro
Thomas Hutton Jefferson, Jr. ..... Westwood, N. J.
Paul David Peterson ..... Leaksville
Ralph Scott, Jr. ..... Kinston
Ralph Edwin Showalter ..... Arden
James Miller Whisnant ..... Lenoir
Bryan Lee Williams ..... Rocky Mount

MASTER OF EDUCATION

Agricultural Education

John Edward Alston ..... Franklinton
Elmer Eugene Capps ..... Princeton
Carlos Manuel Rojas ..... Heredia, Costa Rica

Industrial Education

Louise McLaughlin Beard ..... Durham

‡In Absentia

Occupational Information and Guidance

‡Beatrice Kearney Balkcum ..... Goldsboro
‡Betty Rader Martin ..... Cary

MASTER OF ELECTRICAL ENGINEERING

Michael Ney Hayes ..... Massillon, Ohio
Lowell Hibbard ..... Manchester, Ky.
Kenneth Durwood Kennedy, Jr. ..... Wilson
Walter Eugene Rittle ..... Burlington
James Richard Simon ..... Rosemont, W. Va.
Mohamed Ben Mohamed Smires ..... Casablanca, Morocco
Stavros John Stephanakis ..... Athens, Greece
Michael Thomas Vanecek ..... Pasadena, Texas
Daniel LeRoy Young ..... Manhattan, Kan.

MASTER OF EXPERIMENTAL STATISTICS

‡Kenneth Arthur Busch ..... Cincinnati, Ohio
‡Ildefonso Tolention Cruz ..... Bulacan, Philippines
Moksh Pratap Gautam ..... Agra, India
Walton Carlyle Gregory ..... Raleigh
John Carlyle Lambert ..... Provo, Utah
‡Frederick William Levy ..... New York, N. Y.
Scott Edward Michaels ..... Cincinnati, Ohio
Mohamed Ibrahim Mohamed ..... Kerala, India

MASTER OF FORESTRY

Daniel Lester Holley, Jr. ..... Darlington, S. C.

MASTER OF WOOD TECHNOLOGY

‡Ricardo Ama Clemente ..... Laguna, Philippines

MASTER OF SCIENCE

Agricultural Economics

‡Warren Henry Suchovsky ..... Stephenson, Mich.

Agricultural Engineering

Charlie Grover Coble ..... Holly Hill, S. C.
‡Walter Henry Pitts ..... Newberry, S. C.

Animal Science

Avraam Louca Louca ..... Nicosia, Cyprus
‡Rodolfo Vaccaro ..... Lima, Peru

Botany and Bacteriology

‡Dale Elliott Harrison ..... Spruce Pine
Samir Ali Mohamed ..... Tockh, Egypt

Chemistry

‡Carl Newton Bean, Jr. ..... Asheville
Roy Lee Johnston ..... Raleigh

‡In Absentia

Civil Engineering

Donald Ray Hinson ..... Goldsboro
James Maurice Lynch ..... Sanford
‡George Lindmiller Reed, III ..... Durham

Crop Science

Donald Thomas Cooper ..... Cloverdale, Ind.
Manubhai Tribhovandas Parmar ..... Gujrat, India

Electrical Engineering

‡Abdur Rashid ..... Lahore, Pakistan

Entomology

‡Fausto Humberto Cisneros ..... Lima, Peru
John Daniel Rudder ..... Burlington

Food Science

Emma Santarina Bautista ..... Manila, Philippines

Forest Management

‡Theodore Osgood Hilbourn, III ..... Plymouth
‡Zain-Abidin Hassan Terzi ..... Kirkuk, Iraq

Genetics

‡Fred Thomas Ledig ..... New Brunswick, N. J.

Horticultural Science

Theodore Cline McDowell ..... Ashland, Ohio

Industrial Engineering

‡Bhogilal C. Mehta ..... Calcutta, India

Mathematics

Michael Allan Blackledge ..... Houston, Texas
Richard Joseph Latshaw ..... Minneapolis, Minn.
Robert Earl Thornberry ..... Vienna, Va.
Charles Howard Wheeler ..... Glasgow, Ky.

Mechanical Engineering

Thomas Clay Dellinger ..... Thomasville
Clifton Benedict McFarland, Jr. ..... Camden, S. C.

Mineral Industries

Richard Lee Kennedy ..... Lansing, Mich.

Occupational Information and Guidance

Sandra Helen Bossak ..... Miami, Fla.
Nancy Browning Cooke ..... Raleigh
Virgil Blackledge Harper ..... Kinston
‡James Joseph McMahon ..... Hillside, N. J.
‡Louisa Mordecai Odom ..... Kew Gardens, N. Y.
Blossom M. Reutlinger ..... Raleigh
Annette Parker Sparks ..... Clinton

Physics

‡Richard Andrew Backus ..... Cincinnati, Ohio
I-Hsiun Chen ..... Tainan, Taiwan
James Lester Cox, Jr. ..... Reidsville
William Raymond Thursby, Jr. ..... Bedford, Mass.

‡In Absentia

Plant Pathology

Pedro Luis Melendez ——— Morovis, Puerto Rico

Psychology

‡Richard Clifford Sturtevant ——— Pelham, N. Y.
‡Harold Joel Tragash ——— Bronx, N. Y.

Rural Sociology

Robert Curtis Brisson ——— Tar Heel
Myrle Lutterloh Swicegood ——— Raleigh

Soil Science

Eugene Carter Sample ——— Belzoni, Miss.

Textile Technology

Mohye El-Din Metwalli El-Ayouti ——— Kafr el-Dawar, Egypt

Wood Science and Technology

Gerald Franklin Laughinghouse ——— Vanceboro

Zoology

Frederick Louis Johns ——— Fayetteville
‡Lester Stanley Whitley ——— Saratoga

‡In Absentia

Doctor of Philosophy Degrees

Rodolfo Barriga-Olivares, Plant Pathology
Dissertation: Reproduction and Pathogenicity of Plant-Parasitic Nematodes Associated with Camellia in North Carolina. (Under the direction of Joseph Neal Sasser).

Durham Keith Bell, Plant Pathology
Dissertation: Studies on Root Rot, Stem Necrosis, and Blight of Boxwood Caused by *Phytophthora parasitica* Dastur: A. Influence of Rhizosphere Climate on Pathogenesis; B. Morphological and Physiological Characterization of Populations of *P. parasitica* from Boxwood and Other Hosts. (Under the direction of Frank Arling Haasis).

‡Henry Derrick Blocker, Entomology
Dissertation: A Classification of the Western Hemisphere Balcluthini (Homoptera: Cicadellidae). (Under the direction of David Allan Young).

Melvin Ole Braaten, Experimental Statistics
Dissertation: The Union of Partial Diallel Mating Designs and Incomplete Block Environmental Designs. (Under the direction of Columbus Clark Cockerham).

Frederick Allen Bryan, Jr., Physics
Dissertation: Measurements of the Neutron Absorption Cross Section of Liquid Hydrogen by the Pulsed Neutron Technique. (Under the direction of Arthur Walter Waltner).

John Patrick Bryant, Soil Science
Dissertation: Soils of the Carolina Bays and Interbay Areas in Scotland County, North Carolina. (Under the direction of Ralph Joseph McCracken).

Reverend Joseph Cassidy, O.P., Genetics
Dissertation: Analogue-Induced Experimental Alterations in Longevity, Reproductive Capacity, and Ultrastructure of *Bracon hebetor*. (Under the direction of Daniel Smartwood Grosch).

Laurence Neuman Connor, Jr., Mechanical Engineering
Dissertation: The One-Dimensional Unsteady Expansion of a Reacting Mixture of Gases Considering Vibrational and Chemical Nonequilibrium. (Under the direction of Robert Wesley Truitt).

Nicholas Constantine Costes, Civil Engineering
Dissertation: Non-linear Theory Relating to Visco-compressible Materials with Applications to Snow Mechanics. (Under the direction of Ralph Eigil Fadum).

Robert David Dahle, Agricultural Economics
Dissertation: Managerial Uses of Accounting Information in a Vertically Integrated Broiler Firm. (Under the direction of William Ray Henry).

Lonnie Gene Dalton, Genetics
Dissertation: An Analysis of the Duplicate Fruiting Branch Loci, Cluster and Short Branch, in *Gossypium*. (Under the direction of Stanley George Stephens).

Joan Gwyneth Dyson, Genetics
Dissertation: Natural Selection of the Two Mutant Genes Honey and Orange in Laboratory Populations of *Habrobracon juglandis*. (Under the direction of Ken-ichi Kojima).

‡In Absentia

‡Richard Lee Feltner, Agricultural Economics
Dissertation: Alternative Models of the Feed-Livestock Economy. (Under the direction of Thomas Dudley Wallace).

Major Mereland Goodman, Genetics
Dissertation: Classification, Correlation, and the Structure of Populations. (Under the direction of Stanley George Stephens).

Robert Allen Hann, Wood Science and Technology
Dissertation: An Investigation of the Drying of Wood at Temperatures Above 100 Degrees Centigrade. (Under the direction of Alfred J. Stamm).

‡Roger Noel Harris, Agricultural Economics
Dissertation: Determinants of Central Shopping and Residential Land Values. (Under the direction of George Stanford Tolley).

‡James Raymond Harvey, Experimental Statistics
Dissertation: Fractional Moments of a Quadratic Form in Noncentral Normal Random Variables. (Under the direction of Richard Loree Anderson).

Richard Holbrook, Mechanical Engineering
Dissertation: Investigation of Nonsymmetric Effects in Strip Rolling on Single-roll Drive Mills. (Under the direction of Carl Frank Zorowski).

Birkett Howarth, Jr., Animal Science
Dissertation: The Importance of Environment on Sperm and Zygote as Determined by Subsequent Embryonic Survival in the Rabbit. (Under the direction of Lester Curtis Ulberg).

Paul Harry Jennings, Botany and Bacteriology
Dissertation: The Effects of the Sugary-1 and Shrunken-2 Loci on Total Amylolytic Activity, Phosphorylase Activity, and Carbohydrate Content in Maize. (Under the direction of Clarence Leslie McCombs).

‡Ravindra Nath Kaul, Agricultural Engineering
Dissertation: The Influence of Roots on Certain Mechanical Properties of an Uncompacted Soil. (Under the direction of William Eldon Splinter).

Faysel Said Keblawi, Electrical Engineering
Dissertation: Interaction of Input and Output Filters of a Ring-type Frequency Translator. (Under the direction of George Burnham Hoadley).

‡Chin Kee Lee, Botany and Bacteriology
Dissertation: Studies on the Glucose Dehydrogenase System of *Pediococcus pentosaceus*. (Under the direction of Walter J. Dobrogosz).

‡Jaime Lotero, Soil Science
Dissertation: The Magnitude and Duration of the Effect of Urine Applied by Grazing Cattle on the N and K of Pasture Swards. (Under the direction of William Walton Woodhouse, Jr.).

Charles Douglass Mampe, Jr., Entomology
Dissertation: The Biology of the Plum Curculio (*Conotrachelus nenuphar* (Herbst)) on Blueberry in North Carolina. (Directed by Herbert Henry Neunzig).

Joe Alton Marlin, Mathematics
Dissertation: Solutions of Perturbed Hamiltonian Systems. (Under the direction of Raimond Aldrich Struble).

Donald Crowell Martin, Chemical Engineering
Dissertation: A Study of the Dynamic Response of a Pilot-Plant Distillation Column. (Under the direction of Edward Martin Schoenborn).

‡In Absentia

Joseph Carson Matthews, Jr., Agricultural Economics
Dissertation: Human Resources in the Economy of the Upper French Broad Area. (Under the direction of George Stanford Tolley).

Jehangir Farhad Mirza, Civil Engineering
Dissertation: A Study of Stresses and Deformations in Shallow Prestressed Hyperbolic Paraboloid Shells. (Under the direction of Mehmet Ensar Uyanik).

Jesus Maria Moncada de la Fuente, Soil Science
Dissertation: Influence of Leguminous Plants on the Growth and Nitrogen Nutrition of Associated Grasses. (Under the direction of William Victor Bartholomew).

Claude Wayne Moss, Botany and Bacteriology
Dissertation: Studies of the Effects of Subzero Temperatures on *Escherichia coli*. (Under the direction of Marvin Luther Speck).

David Eugene Nixon, Experimental Statistics
Dissertation: A Study of the Distributions of Two Test Statistics for Periodicity in Variance. (Under the direction of Laurence Jay Herbst and Richard Loree Anderson).

‡Fidencio Puente, Soil Science
Dissertation: Some Effects of Soil Temperature and Phosphorus and Calcium Levels on Cotton Seedling Growth. (Under the direction of James Maurice Spain and Sterling Barg Weed).

Albert Sidney Roberts, Jr., Nuclear Engineering
Dissertation: Production and Analysis of Intense, Undriven Electron Beams with Significant Self-field Forces. (Under the direction of Willard Harrison Bennett).

Drexel Kermit Smith, Mechanical Engineering
Dissertation: Smiliar Solutions for Internal Flows with Suction or Injection at the Wall. (Under the direction of James Clifford Williams, III).

Barry Chapin Starcher, Animal Science
Dissertation: Investigations of Copper Metabolism in Chickens. (Under the direction of Charles Horace Hill).

‡Roland Jay Stipes, Plant Pathology
Dissertation: Comparative Morphology, Pathogenicity, Physiology and Biochemistry of Perithecial Isolates of *Glomerella cingulata* (Ston.) Spauld. et Schrenk Obtained from Different Hosts. (Under the direction of Nash Nicks Winstead).

Charles William Stuber, Genetics
Dissertation: Characterization and Estimation of Genetics Parameters in the Interpopulation Formed by Crossing Two Populations of Maize. (Under the direction of Warren Durward Hanson).

David Boyce Teague, Mathematics
Dissertation: A Boussinesq Problem for a Finite Cylinder. (Under the direction of Ian Naismith Sneddon and Walter Joel Harrington).

Robert Leon Thurstone, Electrical Engineering
Dissertation: Minimizing Tissue Heating in Electro-magnetic Energy Transfer Systems. (Under the direction of Willam John Barclay).

Ernest Ronald Venerus, Nuclear Engineering
Dissertation: Theoretical Investigations of Fission Product Deposition from Flowing Gas Streams. (Under the direction of Mehmet Necati Ozisik).

‡Philip Daniel Whanger, Animal Science

Dissertation: The Effect of Sulfur Depletion on Organic Acid Production and Some Related Effects in the Rumen of the Sheep. (Under the direction of Gennard Matrone).

Milton Guy Williams, Jr., Chemical Engineering

Dissertation: An Evaluation of the Dye Displacement Technique as a Method for Measuring Dye Diffusion Coefficients. (Under the direction of James K. Ferrell).

Joe Yao, Wood Science and Technology

Dissertation: Tests of the Validity of Determining the Distribution of Pit Pore Sizes in Softwoods by a Combination of Overcoming Surface Tension and Rate of Flow. (Under the direction of Alfred Joaquin Stamm).

‡In Absentia

DEGREES CONFERRED

July 16, 1964
August 27, 1964
January 22, 1965

School of Agriculture and Life Sciences

BACHELOR OF SCIENCE IN AGRICULTURAL ENGINEERING

Jointly Administered by Schools of Agriculture and Life Sciences and the School of Engineering

Glenn Alden Moore (January, 1965) ..... Statesville
Thomas Hilliard Satterwhite (January, 1965) ..... Cleveland

BACHELOR OF SCIENCE

Agricultural Economics

Dale Cary Bone (January, 1965) ..... Nashville
Milton Jennings Humphrey, Jr. (January, 1965) ..... Burgaw
Danny Murphy Kesler (January, 1965) ..... Salisbury
Jimmie Dean Tate (January, 1965) ..... Belmont
Millard Wayne Watson (July, 1964) ..... Lucama

Agricultural Engineering

Bruce Kellum Basden (July, 1964) ..... Dudley
Ronald Vasco Jackson (July, 1964) ..... Dunn
Cecil Exum Viverette, Jr. (August, 1964) ..... Lenoir

Animal Science

Richard Wayne Bennett (January, 1965) ..... Ellerbe
David Edgar Iles, Jr. (January, 1965) ..... Littleton
Madison Estridge Johnson (July, 1964) ..... Kinston
Michael Joseph Johnson (August, 1964) ..... Havelock
James Boyce Martin (January, 1965) ..... Florence, S. C.
James Hughie Ray, Jr. (January, 1965) ..... Mars Hill

Botany

Michael Conoly Jackson (January, 1965) ..... Dobson

Crop Science

Dale Cary Bone (January, 1965) ..... Nashville

Entomology

George Anthony Matuza (July, 1964) ..... Hempstead, N. Y.

Food Science

Oris Edwin Holloway, Jr. (August, 1964) ..... New Bern
William Fred Krumanocker (January, 1965) ..... Troy, N. Y.
Billy Brown Maske (August, 1964) ..... Mount Gilead

Horticultural Science

Joseph David Devine, Jr. (January, 1965) ..... Raleigh
Alfred Arthur Graves, Jr. (January, 1965) ..... Raleigh
Michael Conoly Jackson (January, 1965) ..... Dobson
*Maurice Wilson Webster (January, 1965) ..... Cary
Robert Glenn Matthews, Jr. (January, 1965) ..... Wilmington

Poultry Science

Billy Thomas Holt (August, 1964) ..... Burlington

Rural Sociology

Fred Joe Barkley (August, 1964) ..... Lincolnton
Darrell Guy Keener (January, 1965) ..... Lincolnton
Martha Hix McLaughlin (August, 1964) ..... Moravian Falls

Zoology

Cody Brannon Addison (January, 1965) ..... Gastonia
Diane Florence Barriere (August, 1964) ..... Hendersonville
William Ross Bonner (January, 1965) ..... Greensboro
*Reuben Reynolds Cowles, Jr. (July, 1964) ..... Statesville
Donald Neal Dandliker (January, 1965) ..... Greensboro
Joseph Oliver Cromwell Dodge (August, 1964) ..... Richmond, Va.
Jefferson Lodrick Fountain, III (January, 1965) ..... Raleigh
Jerry Lawrence Holloman (January, 1965) ..... Jackson
Dallas Granville Magee (January, 1965) ..... Yale, Va.
James Tift Mann, III (January, 1965) ..... Raleigh
William Harold Nesbitt (July, 1964) ..... Weaverville
Hallet Mathew Pakula (January, 1965) ..... Raleigh
Robert Linn Wilbur (January, 1965) ..... Haverford, Penna.
John Louis Winkler (August, 1964) ..... Raleigh
Robert John Yurcho (August, 1964) ..... Princeton, N. J.

*Honors

School of Design

BACHELOR OF PRODUCT DESIGN

William Kuykendall Huntley (August, 1964) ..... Smithfield

School of Education

BACHELOR OF SCIENCE IN EDUCATION

Agricultural Education

Ray Everett Baker (July, 1964) ..... Buies Creek
Simon Wayne Barber (January, 1965) ..... Jamesville
Hugh Jerome Bennett (January, 1965) ..... Lillington
Larry Delano Brock (July, 1964) ..... Bunnlevel
Larry Eugene Byrd (January, 1965) ..... Burlington
William Harvey Cannon (January, 1965) ..... Grifton
Ronnie Carroll Craven (January, 1965) ..... Concord
Charles Dean Edwards (January, 1965) ..... Sparta
Weldon Wright Faircloth (January, 1965) ..... Autryville
Henry Mack Hobgood (January, 1965) ..... Stem
Carlton Maynard Jenkins (January, 1965) ..... Pink Hill
*William Joe Long (January, 1965) ..... Ash
Jim Tucker Nobles (January, 1965) ..... Dover
Eugene Benjamin Roberson, Jr. (January, 1965) ..... Robersonville
James Edgar Spicer (January, 1965) ..... Elkin

Industrial Arts Education

Carlton Stephen Ashby, Jr. (January, 1965) ..... Havelock
Jonas David Edwards (January, 1965) ..... Pinetops
Colbert Page Howell (January, 1965) ..... Murfreesboro
Emerle Franklin Stephenson, Jr. (January, 1965) ..... Como
Michael Glenn Woolard (January, 1965) ..... Robersonville

*Honors

Mathematics Education

Peter David Auksel (August, 1964) ..... East Chicago, Ind.
John Dwight Hall (January, 1965) ..... Reidsville
Paul Douglas Haskins (January, 1965) ..... Kernersville
Gerhard Chester Henricksen, Jr. (August, 1964) ..... Durham
Gene Monroe McGaha (July, 1964) ..... Waynesville

Science Education

Frederick Louis Beyer, Jr. (July, 1964) ..... Durham
Robert Glen Futrell, Jr. (July, 1964) ..... Murfreesboro
Clifford Ray McCrary, Jr. (July, 1964) ..... Lexington

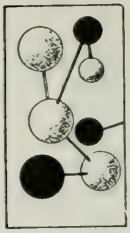
BACHELOR OF SCIENCE IN INDUSTRIAL ARTS

Rosario Salvatore Amato (January, 1965) ..... Easton, Penna.
Carlton Edward Baird (August, 1964) ..... Roanoke Rapids
Jacob Vosk Falbaum (January, 1965) ..... Winston-Salem
William Edward Felts, Jr. (January, 1965) ..... Rocky Mount
Lloyd Thomas Funderburk, Jr. (January, 1965) ..... Charlotte
John Paul Garriss, Jr. (January, 1965) ..... Conway
John William Grainger, II (July, 1964) ..... Clarendon
Roy Donald Harrelson (July, 1964) ..... Clarkton
Charles Harvey Hennis (January, 1965) ..... Mount Airy
Dale Reid Johnson (July, 1964) ..... Burlington
James Lloyd Jones (January, 1965) ..... Kenly
Halstead Wheeler McAdoo (January, 1965) ..... Greensboro
Leighton Edward McGinn, Jr. (August, 1964) ..... Charlotte
William Joseph Parish (January, 1965) ..... Winston-Salem
Monroe Holland Phillips, Jr. (January, 1965) ..... Burlington
James Harold Smith (January, 1965) ..... Selma
Sidney Gray Steifel, Jr. (January, 1965) ..... Winston-Salem
Edwin Alvis Westmoreland (July, 1964) ..... Winston-Salem

BACHELOR OF SCIENCE IN RECREATION AND PARK ADMINISTRATION

Glen Mikel Crummie (July, 1964) ..... Fayetteville
Claude Andrew Gibson (January, 1965) ..... Asheville
George William Hayworth (January, 1965) ..... High Point
James Joseph Keller (August, 1964) ..... Somers Point, N. J.
Anthony Paul Koszarsky, Jr. (January, 1965) ..... Pittsburgh, Penna.
Gerald Joseph Krecicki (January, 1965) ..... Trenton, N. J.
Edgar Johnny Moneyhan (July, 1964) ..... Fayetteville
Patrick Jennings Powell (January, 1965) ..... Canton
Donald Lee Rufty (January, 1965) ..... Salisbury
Don Barry Smith (January, 1965) ..... Roanoke, Va.

School of Engineering



BACHELOR OF SCIENCE IN AEROSPACE ENGINEERING

Robert Chapman Anderson (January, 1965) ..... Raleigh
Robert Halverson Brown (January, 1965) ..... Swannanoa
Larry Eugene Choplin (January, 1965) ..... Winston-Salem

BACHELOR OF SCIENCE IN CERAMIC ENGINEERING

Russel Littleton Cato, Jr. (January, 1965) ..... Emporia, Va.
Bryan Stallings Dixon (January, 1965) ..... Durham
John Calvin Foushee (January, 1965) ..... Sanford

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

John Marshall Edwards (August, 1964) ..... Charlotte
William Finley Johnson (August, 1964) ..... Oxford
Michael Clifton Lee (August, 1964) ..... Gastonia
Arthur Dixon Smith (August, 1964) ..... Thomson, Ga.
Warren Randolph Tyler (August, 1964) ..... Raleigh

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

Ned Ryan Bivens (August, 1964) ..... Kannapolis
Clarence Richard Moore (January, 1965) ..... Wilson
James O'Dell Morrison (August, 1964) ..... Southern Pines

BACHELOR OF SCIENCE IN CIVIL ENGINEERING, CONSTRUCTION OPTION

Phillip McCoy Berrier (January, 1965) ..... Kernersville
Mark Thomas Goodson (July, 1964) ..... Asheville
Don Blackwell Jessup (January, 1965) ..... Fayetteville
Bruce Howland Overman, Jr. (January, 1965) ..... Greensboro
William Curtis Sides, Jr. (July, 1964) ..... Winston-Salem
Adron Taylor Smith, Jr. (July, 1964) ..... Charlotte

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

James Franklin Adkins (January, 1965) ..... Stoneville
Everett Alan Baker (July, 1964) ..... Wadesboro
Thomas Oliver Britt (January, 1965) ..... Raleigh
George Ellis Carawan (January, 1965) ..... Belhaven
Stamie Sherrill Cline, Jr. (August, 1964) ..... Raleigh
Larry Orlin Cruse (January, 1965) ..... Charlotte
Bruce Alfred Curlee (January, 1965) ..... Albemarle

Richard Lee Cutchin (January, 1965) ..... Norfolk, Va.
William Everette Dawes (January, 1965) ..... Elm City
William Lloyd Driver (January, 1965) ..... Raleigh
Buster Cleveland Glosson (January, 1965) ..... Greensboro
Joel David Hill (August, 1964) ..... Carolina Beach
John Howard Howell, Jr. (January, 1965) ..... New Bern
Walter Bascomb Jones, Jr. (January, 1965) ..... Raleigh
Robert John Kunka (January, 1965) ..... Jacksonville
Pantelis Kyriakos Kyriakidis (January, 1965) ..... Athens, Greece
Luther Vance Lewis (January, 1965) ..... Union Mills
Demetrios Andreas Michalopoulos (January, 1965) ..... Athens, Greece
Lester Eugene Misenheimer (January, 1965) ..... Faith
Johnny Dean Oliver (July, 1964) ..... Havelock
Thomas McPherson Royal (January, 1965) ..... Raleigh
**Wallace Edward Smith (January, 1965) ..... Charlotte
Paul Eugene Summers, Jr. (July, 1964) ..... Washington, D. C.
James Edward Teague, III (August, 1964) ..... Hickory
Stokes White, Jr. (August, 1964) ..... Concord
Brooks Monroe Williams (January, 1965) ..... Wilson
William James Zehner (August, 1964) ..... Dayton, Ohio

BACHELOR OF SCIENCE IN FURNITURE MANUFACTURING AND MANAGEMENT

James Wayne Braddock (August, 1964) ..... Asheville
Daniel Rader Little (January, 1965) ..... West Jefferson
David Franklin Morgan, Jr. (January 1965) ..... Monroe
Pressley Lythanuel Turbyfill (January, 1965) ..... Maiden
Jeffery Ellis Wright (July, 1964) ..... Burlington

BACHELOR OF SCIENCE IN GEOLOGICAL ENGINEERING

Berkley Roger Carter (January, 1965) ..... Reidsville
Norman Thomas Cochrane (July, 1964) ..... Skaneateles, N. Y.
Arthur Raymond Fleetwood (July, 1964) ..... Monterey, Calif.

BACHELOR OF SCIENCE IN INDUSTRIAL ENGINEERING

John David Cartlidge, Jr. (August, 1964) ..... Raleigh
Charles Bennett Griffin, III (July, 1964) ..... Woodville
Stephen Hugh Hill (August, 1964) ..... Albemarle
James Earle Kluttz (August, 1964) ..... Salisbury
Kenneth Wayne Nichols (July, 1964) ..... Marion
Thaddeus Terrell Russell, Jr. (January, 1965) ..... Granite Falls
John Voorhis Soden, Jr. (July, 1964) ..... Raleigh
William Paul Sucher (January, 1965) ..... Woodmere, N. Y.
Jere Manley Thomas, Jr. (August, 1964) ..... Charlotte

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

Raymond Edward Barry, Jr. (August, 1964) ..... Shelby
Cecil Roland Bell, Jr. (July, 1964) ..... Pilot Mountain
Max Earl Benfield (August, 1964) ..... Hickory

** High Honors

Robert Charles Brown (July, 1964) ..... Charlotte
Peter John Chimos (July, 1964) ..... Raleigh
Robert Crump Corning, Jr. (August, 1964) ..... Rockingham
William Michael DePriest (January, 1965) ..... Winston-Salem
Van Dawson Durrett, Jr. (July, 1964) ..... Tampa, Fla.
Terry Lee Furr (August, 1964) ..... Concord
Peter Robert Gernert (January, 1965) ..... Andrews
Roscoe David Griffin (August, 1964) ..... Durham
Clifford Marvin Hammond (July, 1964) ..... Rowland
Wilson Hill Hepler (July, 1964) ..... Thomasville
Jerry Blanton Kilpatrick (January, 1965) ..... Chapel Hill
Donald Gerald Lambert (August, 1964) ..... Albemarle
William Jennings Lane, Jr. (July, 1964) ..... Asheboro
Carlton Donald Marshall (August, 1964) ..... Wilmington
William Manfred Maultsby (August, 1964) ..... Wilmington
Herman Alexander Overcash, Jr. (August, 1964) ..... Charlotte
Roy Thomas Parrish (July, 1964) ..... Sanford
Larry Steve Phillips (July, 1964) ..... Hickory
James Ray Rutledge (January, 1965) ..... Statesville
Conrad Lee Scarboro (August, 1964) ..... Norwood
Carl Bernard Schutt (August, 1964) ..... Wilmington
**William Woodrow Simpson, Jr. (July, 1964) ..... Durham
James Andrew Sink, Jr. (July, 1964) ..... Thomasville
George Rayvon Smith (July, 1964) ..... Mount Gilead
Marvin Caulis Todd, Jr. (January, 1965) ..... Ahoskie
Robert Dwight Winn, Jr. (July, 1964) ..... Mooresboro

Mechanical Engineering, Aerospace Option

John Loman Ellis (August, 1964) ..... Montgomery, Ala.
George Donald Hammersla, Jr. (July, 1964) ..... Hickory
Harry Langren Murray (August, 1964) ..... Charlotte

BACHELOR OF SCIENCE IN METALLURGICAL ENGINEERING

Richard Earl Culp (January, 1965) ..... Asheville
Oliver Thomas Hayes, III (January, 1965) ..... Winston-Salem
Richard Howard Parker, Jr. (August, 1964) ..... Taunton, Mass.
George Manning Rowe, Jr. (January, 1965) ..... Fairfield, Conn.
Titus Odell Sills, Jr. (August, 1964) ..... Kannapolis

BACHELOR OF SCIENCE IN NUCLEAR ENGINEERING

Robert LeRoy Campbell, Jr. (August, 1964) ..... Hickory
*Martin William Herman (July, 1964) ..... Edgewood, Md.
Jesse Baxter Lee (August, 1964) ..... Laurinburg
*Samuel Darden Lovelace, Jr. (July, 1964) ..... Wilson
Ing Mao Tang (August, 1964) ..... Taiwan, China
John William Woody (January, 1965) ..... Leaksville

*Honors **High Honors

School of Forestry

BACHELOR OF SCIENCE IN FOREST MANAGEMENT

Robert Branch Bourne (August, 1964) ..... Raleigh
Jackson Kimsey Coleman (January, 1965) ..... Murphy
Gerald Leroy Dotson (January, 1965) ..... Colonial Heights, Va.
Earl Langston Dutton (January, 1965) ..... Whiteville
Charles Edwin Gentry (January, 1965) ..... Weaverville
William Francis Lang (July, 1964) ..... Thornwood, N. Y.
Woodridge Randolph Roberts (July, 1964) ..... Asheville
James Fleetwood Shotwell, Jr. (August, 1964) ..... Roxboro
William Golden Simpson (January, 1965) ..... Plymouth
Samuel Marmon Thompson (January, 1965) ..... Spruce Pine

BACHELOR OF SCIENCE IN PULP AND PAPER TECHNOLOGY

George Richard O'Hara (July, 1964) ..... Georgetown, S. C.
Furman Douglas Owenby (January, 1965) ..... Black Mountain

BACHELOR OF SCIENCE IN WOOD TECHNOLOGY

*Keith Anthony Bennett (January, 1965) ..... Springfield, Va.
John Francis Carey (July, 1964) ..... Charlotte
Philip Campbell English (August, 1964) ..... Jacksonville
Gene James Meyer (August, 1964) ..... Woodside, N. Y.
Ronald Harry Paton (August, 1964) ..... Sodus, N. Y.

School of Liberal Arts

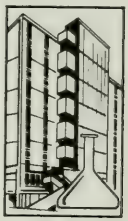
BACHELOR OF ARTS

David Edward Angell (August, 1964) ..... Winston-Salem
*Barbara Horne Connell (January, 1965) ..... Rocky Mount

*Honors

James Darius Duncan, Jr. (January, 1965) ..... Raleigh
Michael Robert Edwards (August, 1964) ..... Thomasville
**Louise B. Finlayson (August, 1964) ..... Raleigh
Fayeq Abdeljawad Husein (July, 1964) ..... El-Bireh, Jordan
Richard Kinney Moore (August, 1964) ..... Alexandria, Va.
Thomas Connor Murray (July, 1964) ..... Raleigh
William Rossiter Peabody (January, 1965) ..... Raleigh
Sarah Anne Sanders (August, 1964) ..... Raleigh
James David Shelton (January, 1965) ..... High Point
Thomas Tyson Swain, Jr. (January, 1965) ..... Burlington
Hoyt Webster Whidbee, Jr. (January, 1965) ..... Engelhard

School of Physical Sciences and Applied Mathematics



BACHELOR OF SCIENCE IN APPLIED MATHEMATICS

Joseph Coors, Jr. (August, 1964) ..... Golden, Colo.
Charles Stephen Daves (January, 1965) ..... Boiling Springs
George Foard Fowler, Jr. (July, 1964) ..... Salisbury
Robert Carroll Green (July, 1964) ..... Waynesville
*Rebecca Ann Miller Howard (July, 1964) ..... Knoxville, Tenn.
John Wesley Marrow, III (August, 1964) ..... Plymouth
Clarissa Mason (January, 1965) ..... Washington
Ransom Snyder Meade, Jr. (January, 1965) ..... Jacksonville, Fla.
David Barclay Raynor (January, 1965) ..... Greensboro
*Alfred Kenneth Sampson, Jr. (January, 1965) ..... Greensboro
David Harold Shook (January, 1965) ..... Statesville
Robert Michael Steinberg (July, 1964) ..... Woodmere, N. Y.
Margaret Long Stephenson (August, 1964) ..... Como
**John Cornelius Theys, Jr. (August, 1964) ..... Raleigh
Jackie Owen Watson (January, 1965) ..... Greensboro

BACHELOR OF ~~SCIENCE~~ IN CHEMISTRY

**Elbert Carl Anderson, Jr. (January, 1965) ..... Wilmington
Michael Eugene Beard (January, 1965) ..... Erwin
Austin Craig Cooley (July, 1964) ..... Black Mountain
Kenneth Grimes McDaniel (January, 1965) ..... Lexington

*Honors **High Honors

BACHELOR OF SCIENCE IN EXPERIMENTAL STATISTICS

William Floyd Dennis (August, 1964) ——— Durham
Henry Claude Sawyer (January, 1965) ——— Durham

BACHELOR OF SCIENCE IN PHYSICS

John Alfred Kendrick (August, 1964) ——— Gastonia
**Woodrow Richard Tingle (January, 1965) ——— Bayboro
James Ray Washburn (July, 1964) ——— Spruce Pine

School of Textiles

BACHELOR OF SCIENCE IN TEXTILE CHEMISTRY

*Charles William Bowman (January, 1965) ——— Ontario, Canada
*Mohamed Hamed Ghanem (August, 1964) ——— Alexandria, Egypt
Thad Morris McGahey (July, 1964) ——— Washington
Ismail Suleyman Misirli (January, 1965) ——— Istanbul, Turkey
*William James Oakes (July, 1964) ——— Quebec, Canada
Hugh Anthony Padgett (July, 1964) ——— Forest City
*Jacques Noel St-Onge (July, 1964) ——— Quebec, Canada
Joel Lawson Williams (January, 1965) ——— Pink Hill

BACHELOR OF SCIENCE IN TEXTILE TECHNOLOGY

**Bernardus Alders (January, 1965) ——— Ontario, Canada
Bernard Rex Allman (July, 1964) ——— Parkersburg, W. Va.
Philip Marston Averett (January, 1965) ——— Salemburg
James Gunter Billings (July, 1964) ——— Durham
Douglas Arthur Brackett (August, 1964) ——— Charlotte
Fred Lovelace Burgin, Jr. (January, 1965) ——— Forest City
John Alex Bynum, Jr. (January, 1965) ——— Raleigh
Ernest John Chornyei, Jr. (January, 1965) ——— Westerly, R. I.
Marion Michael Clark (August, 1964) ——— Canton
*Real J. B. Cote (January, 1965) ——— Quebec, Canada
Jimmy Ray Covington (January, 1965) ——— Gastonia
Kenneth Bernard Crowell (January, 1965) ——— Oakboro
Jesse Milton Deal (January, 1965) ——— Kannapolis
Jean Claude Enriquez (August, 1964) ——— Mexico City, Mexico
**Chiu Laurence Fang (January, 1965) ——— Hong Kong

*Honors **High Honors

*Oscar Augusto Rache Ferreira (January, 1965) ..... Guanabara, Brazil
Philip Carson Goins (January, 1965) ..... Roseboro
Charles Paisley Gordon (January, 1965) ..... Greensboro
Emmett Smith Grogan (August, 1964) ..... Martinsville, Va.
Lyndon Wade Guthrie (January, 1965) ..... Burlington
Donald Gray Hanes (July, 1964) ..... Salisbury
Owen Robert Hill (July, 1964) ..... Kannapolis
James Alexander Howell (August, 1964) ..... Albemarle
Alvin Lee James (August, 1964) ..... Forest City
Larry Stuart Jenkins, Jr. (August, 1964) ..... Raleigh
*Tevfik Mete Kantar (January, 1965) ..... Izmir, Turkey
*Metin Kayaman (January, 1965) ..... Izmir, Turkey
**Mohamed Ibrahim Khalil (August, 1964) ..... Alexandria, Egypt
Michael Harlee Long (July, 1964) ..... Mooresville
Lexie Lewis Love (January, 1965) ..... Fuquay-Varina
William Farmer McGinty (August, 1964) ..... Charlotte
Seldon Siu-Don Ma (August, 1964) ..... Hong Kong
Marvin Hawley Mason, Jr. (August, 1964) ..... Rutherfordton
Michael Dainis Mayer (January, 1965) ..... Charlotte
Byron LeRoy Mead (January, 1965) ..... Raleigh
James William Miller (January, 1965) ..... Cooleemee
*Richard Charles Moore (August, 1964) ..... Montreal, Canada
Robert Hayes Moore, Jr. (January, 1965) ..... Durham
Jack Crawford Morris (January, 1965) ..... Wadesboro
*James Lindberg Parrish (January, 1965) ..... Bladenboro
Peter Wells Peiffer (January, 1965) ..... Rochester, N. Y.
Joe Harrison Penley, III (January, 1965) ..... Salisbury
Jerry Wayne Rogers (January, 1965) ..... Kannapolis
Allen Wayne Smith (August, 1964) ..... Cordova
James Carl Swink (January, 1965) ..... Darlington, S. C.
Elliott Jay Terman (January, 1965) ..... New York City, N. Y.
**Mohamed Abdelhamid Tharwat (August, 1964) ..... Alexandria, Egypt
James Howard Walker (January, 1965) ..... Boonville
Oscar Thomas Walker (July, 1964) ..... Whiteville
James Roberts Wiggins (July, 1964) ..... Louisburg
Joseph Speed Williams, III (January, 1965) ..... Greensboro
Robert Keith Williams (January, 1965) ..... Newton Grove
*Albert Benton Womble (July, 1964) ..... Sanford
Adnan Zirkli (January, 1965) ..... Damascus, Syria

Professional Degrees

Civil Engineer, Soil Mechanics and Foundation Option

Sherwood Paul Lucas (January, 1965) ..... Dunn

Electrical Engineer

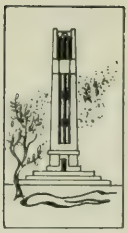
Herbert Bernard Hart, Jr. (January, 1965) ..... Raleigh

Metallurgical Engineer

Robert Lewis Jacobs (January, 1965) ..... Rutherfordton

*Honors **High Honors

Master's Degrees



MASTER OF AGRICULTURE

Yilmaz Esensoy (January, 1965) ..... Ankara, Turkey
Marcil Jara-Almonte (January, 1965) ..... Lima, Peru
Arif Hikmet Ugur (January, 1965) ..... Antalya, Turkey

MASTER OF APPLIED MATHEMATICS

Ann Louise Bellis (August, 1964) ..... Black Mountain
Willard Lee Garrison (August, 1964) ..... Los Angeles, Calif.
Joseph Allen Huggins (January, 1965) ..... Wilmington
James Lewis Klingerman, Jr. (August, 1964) ..... Oakdale, Penna.
Euell Calhoun Richardson, Jr. (August, 1964) ..... Cartersville, Ga.
Gary Douglas Richardson (August, 1964) ..... Siler City
Ellis Eldward Whitt (January, 1965) ..... Trinity

MASTER OF EDUCATION

Agricultural Education

Philip Leo Beaman (January, 1965) ..... Walstonburg
Jesse Floyd Grimes (July, 1964) ..... Pikeville
Fred William Manley (January, 1965) ..... Fuquay-Varina
Edward Howell Wilson (January, 1965) ..... Blanche

Industrial Arts

Charles Paul Stanley, Jr. (January, 1965) ..... Williamston
William John Vander Wall (July, 1964) ..... Raleigh

INDUSTRIAL EDUCATION

Roy Barrow (January, 1965) ..... Wilson
Merton Heywood Branson (January, 1965) ..... Asheboro
Harold K. Collins (January, 1965) ..... Durham
Larry Wilson Johnson (January, 1965) ..... Raleigh
John Lane Roberson (January, 1965) ..... Asheboro
Lester Jack Wilson (January, 1965) ..... Arlington, Va.

Occupational Information and Guidance

Evelyntyne Humphrey Dempsey (January, 1965) ..... Raleigh
Ethel Perkins Edwards (July, 1964) ..... Raleigh

MASTER OF ELECTRICAL ENGINEERING

Gale Saben Fly (January, 1965) ..... Mobile, Ala.
William Bryan French, II (January, 1965) ..... Waynesboro, Tenn.

Roger Perkins Gray, Jr. (August, 1964) ..... Winston-Salem
Douglas Seaton Lilly (August, 1964) ..... Abingdon, Va.
Edward James Mack (July, 1964) ..... Wilmington
James Price Moffatt (January, 1965) ..... Baltimore, Md.
James Richard Stidham (January, 1965) ..... Raleigh

MASTER OF EXPERIMENTAL STATISTICS

Julio Roger Arroyo (January, 1965) ..... Lima, Peru
Victor Rene Gomez Sandoval (August, 1964) ..... Concepcion, Chile
Chaudhri Muhammad Afzal Khan (August, 1964) ..... Lahore, Pakistan
Donald Maynard Olsson (January, 1965) ..... Crystal Lake, Ill.
Albert William Sherdon (January, 1965) ..... Lancaster, Penna.

MASTER OF FORESTRY

William Donald Pepper (January, 1965) ..... East Tallassee, Ala.
Paul Willard Perry (January, 1965) ..... Edinboro, Penna.
Gerald Martin Garthe (January, 1965) ..... Santa Ana, Calif.

MASTER OF TEXTILE TECHNOLOGY

Marc H. Edwards (July, 1964) ..... New York City, N. Y.
George Calvin Picht (January, 1965) ..... Pittsburgh, Penna.

MASTER OF SCIENCE

Agricultural Economics

William McKallip Bateson (January, 1965) ..... Salem, Ore.
Filmore Edmund Bender (January, 1965) ..... Bakersfield, Calif.
Arthur Franklin Bordeaux, Jr. (January, 1965) ..... Ingold
Leon Ellsworth Danielson (August, 1964) ..... Luck, Wis.
Edmund Frederick Jansen, Jr. (August, 1964) ..... Quincy, Ill.
Wallace O'Neil Parker (January, 1965) ..... Hubert
Denver Devon Robinson (January, 1965) ..... Asheville

Agricultural Engineering

James Robert Cooke (January, 1965) ..... Huntersville
Richard Lyle Eide (January, 1965) ..... Rushmore, Minn.
Ching Seng Fang (August, 1964) ..... Chung-Ching, China
Pang Feng Hwang (August, 1964) ..... Formosa, Taiwan
Jerry Marion Page (August, 1964) ..... Sumter, S. C.
Darrell Lynn Roberts (July, 1964) ..... Tampa, Fla.
Thomas Burton Whitaker (July, 1964) ..... Raleigh

Animal Science

Glenn Norman Cunningham (August, 1964) ..... Spring City, Tenn.
Daniel Shelley Peters (January, 1965) ..... Shawnee-Mission, Kan.
Charles Keith Vincent (January, 1965) ..... Jet, Okla.

Applied Mathematics

John Nelson Tunstall (August, 1964) ..... Raleigh

Botany and Bacteriology

John Lester Edwards, Jr. (July, 1964) ..... Waynesville
Thomas Otis Henderson (July, 1964) ..... Hickory

Ceramic Engineering

Garland Elmo Scott, Jr. (August, 1964) ..... Raleigh

Chemistry

Pe-Hwa Luh Hsiung (January, 1965) ..... Kiangsi, China
Lilia San Pedro Madamba (January, 1965) ..... College, Laguna, Philippines

Civil Engineering

Ray Barnes (January, 1965) ..... High Point
Henry Melvin Bennett (January, 1965) ..... Calhoun, Ky.
Edward Morton Byrd (July, 1964) ..... Orrum
Raul Cardenas (January, 1965) ..... Quito, Ecuador
Nelson Silveira de Godoy (January, 1965) ..... S. Paulo, Brazil
Hugh Dallas McDonald (January, 1965) ..... Lillington
Fuad Akil Rihani (August, 1964) ..... Al-Husn, Jordan
James Frederick Stevenson (July, 1964) ..... Palmyra
Thomas Man Yang (January, 1965) ..... Taipei, Taiwan

Crop Science

Donald Royce Mohorn (January, 1965) ..... Middlesex
Ratnakar Nijalingappa Sangolli (January, 1965) ..... Mysore, India

Entomology

Hans Otto Langlitz (January, 1965) ..... Hessen, West Germany

Forest Management

Bohun Baker Kinloch, Jr. (January, 1965) ..... Charleston, S. C.
Richard Ernest Pegg (January, 1965) ..... Queensland, Australia
Asham Sultan Sulaiman (January, 1965) ..... Baghoad, Iraq
Christopher Alan Tabor (January, 1965) ..... Raleigh

Genetics

Jaime Castillo Z (January, 1965) ..... Chinchina, Caldas, Colombia
Edward Joseph Klekowski, Jr. (July, 1964) ..... Indianapolis, Ind.
James John Nagle (January, 1965) ..... Ashley, Penna.
Tomoko Ohta (July, 1964) ..... Tokyo, Japan

Geological Engineering

Barry Austin Centini (August, 1964) ..... Lancaster, Penna.
Charles Pernell Gupton (August, 1964) ..... Louisburg

Horticultural Science

John Rex McDonald (January, 1965) ..... Cameron

Industrial Arts

John Brinkley Finch (January, 1965) ..... Laurinburg

Industrial Education

William Alexander McIntosh (August, 1964) ..... Charlotte

Industrial Engineering

Jagadishchandra Devsi Jansari (January, 1965) ..... Baroda, Gujarat, India
Bruce Edward Suppes (August, 1964) ..... Saginaw, Mich.
Manmohan Krishan Wig (January, 1965) ..... New-Delhi, India

Mechanical Engineering

Raymond Shields Dickson (January, 1965) ..... Clover, S. C.
Wen-chen Huang (August, 1964) ..... Tainan, Taiwan
George Fong-jen Lee (August, 1964) ..... Kaoshung, Taiwan
Eugene Huffman Matkins (August, 1964) ..... Elon College
James Russell Noles (July, 1964) ..... Burlington
Robert Tien-Tsai Yang (July, 1964) ..... Miaoli, Taiwan

Metallurgical Engineering

John Gilbert Avery (August, 1964) ..... Lansing, Mich.
Brian Belk Helms (August, 1964) ..... Greensboro

Nuclear Engineering

Richard James Hemler (January, 1965) ..... Gettysburg, Penna.
Alvin Leigh Jenkins (January, 1965) ..... Knoxville, Tenn.
George McBurney Makely (January, 1965) ..... Lynchburg, Va.
Jatindra Kumar Saha (August, 1964) ..... Dacca, East Pakistan

Occupational Information and Guidance

Lorraine Glenn Simms (January, 1965) ..... Raleigh

Physics

Sam Glenn Beard, Jr. (January, 1965) ..... Pittsboro
Leland Moore Hairr (January, 1965) ..... Goldsboro
Ernest Harrison, Jr. (August, 1964) ..... Raleigh
George Delno Kerr (January, 1965) ..... Circleville, Ohio
Edward Samuel Oberhofer (August, 1964) ..... Winston-Salem
Charles Russell Philbrick (August, 1964) ..... Cary

Physiology

John Cedric Dill (August, 1964) ..... Vancouver, B. C.

Plant Pathology

Thomas Miller (August, 1964) ..... Asheville
Donald Theodore Myren (August, 1964) ..... Baldwin, Wis.

Poultry Science

John Nathan Hathcock (August, 1964) ..... Marshville

Psychology

Hugh Alton Boyd, Jr. (January, 1965) ..... McComb, Miss.
Joel Phillip Citron (August, 1964) ..... Raleigh
John Quackenboss Cost (August, 1964) ..... Highland Park, N. J.
James Richard Frazier (August, 1964) ..... Charlotte
John Churchill Gorham, Jr. (January, 1965) ..... Rocky Mount
Dorothy Ann Hill McDonald (January, 1965) ..... Raleigh
Emory Welch Sadler (January, 1965) ..... Kenansville
Marvin Leroy Simner (January, 1965) ..... Syracuse, N. Y.

Rural Sociology

Julian Devon Mosley (January, 1965) ..... Creedmoor
Robert David Mustian (January, 1965) ..... Kittrell
Charles William Pettus (August, 1964) ..... Raleigh
David Charles Ruesink (January, 1965) ..... Adrian, Mich.

Soil Science

Rafael Enrique Gonzalez (August, 1964) ..... Maracay, Venezuela
Rafael Agustin Pinto (July, 1964) ..... Maracay, Venezuela

Textile Chemistry

Uler Recep Gokcen (August, 1964) ..... Istanbul, Turkey
C. G. Govindan Namboori (January, 1965) ..... Kerala, India
William George Steinmiller, Jr. (August, 1964) ..... Williamsburg, Va.
Sukru Tomris Tarim (January, 1965) ..... Ankara, Turkey

Textile Technology

James Bernice Arthur (January, 1965) ..... Charlotte
Ahmed El-Sayed El-Sersy (August, 1964) ..... Alexandria, Egypt
Thomas Edwin McCall, Jr. (August, 1964) ..... Black Mountain

Wood Science and Technology

Von Lenord Byrd (January, 1965) ..... Kodak, Tenn.
William Edmond Smith (January, 1965) ..... Jacksonville, Fla.
Jerry Lee Snyder (January, 1965) ..... St. Albans, W. Va.
Charles Lewis Stayton (August, 1964) ..... Champaign, Ill.
James Garfield Wilfong (July, 1964) ..... Buckhannon, W. Va.

Zoology

Robert Franklin Soots, Jr. (January, 1965) ..... Midland

Doctor of Philosophy Degrees

Rodolfo Jesus Aguilar, Civil Engineering, (August, 1964)
Dissertation: A Study of the Stability of Framed, Triangulated Geodesic Domes under the Action of Concentrated Loads. (Under the direction of Donald McDonald and Charles Raymond Bramer).

Can Cafer Akkoc, Civil Engineering, (August, 1964)
Dissertation: The Use of Optical Diffraction Phenomena in Studies of Elastic-Plastic Strains Near Sharp Notches. (Under the direction of Robert Alden Douglas and Mehmet Ensar Uyanik).

Ozer Ali Arnas, Mechanical Engineering, (January, 1965)
Dissertation: Nonequilibrium Thermodynamic Analysis of Magnetosolidmechanics with Device Applications. (Under the direction of Munir Ridha El-Saden).

Almiro Blumenschein, Genetics, (July, 1964)
Dissertation: Identification of Chromosome Segments That Contribute to the Specificity of Racial Characteristics in Maize. (Under the direction of Benjamin Warfield Smith, Barbara McClintock and William Lacy Brown).

Wayne Elwood Boyet, Agricultural Economics, (January, 1965)
Dissertation: Area Complex and National Park Recreation Demand Projection. (Under the direction of George Stanford Tolley).

Joel Vincent Brawley, Jr., Applied Mathematics, (August, 1964)
Dissertation: Canonical Forms under Similarity for Involutory Matrices over Residue Class Rings of Integers. (Under the direction of Jack Levine).

David Lewis Bruck, Genetics, (January, 1965)
Dissertation: The Origin and Development of Sexual Isolation. (Under the direction of Columbus Clark Cockerham).

Edward Blair Burnside, Animal Science, (January, 1965)
Dissertation: Estimation of the Genetic Trend for Production in a Dairy Cattle Population. (Under the direction of James Edward Legates).

Charles Team Carley, Jr., Mechanical Engineering, (January, 1965)
Dissertation: Rarefied Gas Flow in a Short Tube. (Under the direction of Frederick Otto Smetana).

Tuncer Cebeci, Mechanical Engineering, (January, 1965)
Dissertation: Dynamic Stability of Flow Oscillations in a Heated Channel. (Under the direction of M. Necati Ozisik).

Charles William Crum, Genetics, (January, 1965)
Dissertation: Epistatic Effects and Inbreeding Depression of Three Performance Levels in Two Populations of *Zea Mays* L. (Under the direction of Robert Harry Moll).

James William Daughtry, Physics, (January, 1965)
Dissertation: Temperature Dependence of the Thermal Neutron Properties of Heavy Water. (Under the direction of Arthur Walter Waltner).

Culver Jackson DeLoach, Jr., Entomology, (August, 1964)
Dissertation: Biology, Ecology and Description of *Winthemia* n. sp. (Diptera: Tachinidae), a Parasite of the Tobacco Hornworm. (Under the direction of Robert Lamar Rabb).

William David Diehl, Agricultural Economics, (January, 1965)
Dissertation: Farm-Nonfarm Migration in the Southeast: A Costs-Returns Analysis. (Under the direction of Thomas Dudley Wallace).

Dwight Francis Gordon, Jr., Food Science, (August, 1964)
Dissertation: Isolation and Characterization of a Bitter Peptide from Milk Cultures of *Streptococcus cremoris*. (Under the direction of Marvin Luther Speck).

Earl Thomas Gritton, Crop Science, (January, 1965)
Dissertation: The Inheritance of the Mode of Reaction to Fusarium Wilt in Flue-Cured Tobacco. (Under the direction of Guy Langston Jones).

Franklin Delano Hart, Mechanical Engineering, (January, 1965)
Dissertation: Investigation of Incipient Mechanical Separation Phenomena in Elastic Systems Subjected to Boundary Excitation. (Under the direction of Carl Frank Zorowski).

Clarence Elam Hood, Jr., Agricultural Engineering, (August, 1964)
Dissertation: Temperature Progression During Cooling of Pickling Cucumbers. (Under the direction of Francis Jefferson Hassler).

Jerry Roy Lambert, Agricultural Engineeing, (July, 1964)
Dissertation: A Method of Detemining the Water Potential of Intact Plants. (Under the direction of Jan van Schilfgaarde).

Wilson Durward Leggett, III, Nuclear Engineering, (August, 1964)
Dissertation: The Effect of Pipes on Gamma-ray Dose Rate in a Nuclear Reactor Shield. (Under the direction of Wesley Osborne Doggett).

Julio Heriberto Lopez-Rosa, Plant Pathology, (August, 1964)
Dissertation: Host-Parasite Relations and Epiphytology of Tar Spot of Lespedeza Caused by *Phyllachora Lespedezae*. (Under the direction of Don Edwin Ellis).

George William McClure, Jr., Soil Science, (July, 1964)
Dissertation: Aspects of Nutrient Distribution in Root Zones with Special Reference to Phosphorus. (Under the direction of William Addison Jackson).

Cesar Palting Madamba, Plant Pathology, (August, 1964)
Dissertation: Some Characteristics of the Effects of *Meloidogyne* spp. on Unsuitable Host Crops. (Under the direction of Joseph Neal Sasser).

John Gilbert Magistad, Experimental Statistics, (August, 1964)
Dissertation: Some Steady-State and Transient Solutions for Sampled Queues. (Under the direction of Richard Loree Anderson).

Ronald Lee Malcolm, Soil Science, (August, 1964)
Dissertation: Mobile Soil Organic Matter and Its Interactions with Clay Minerals and Sesquioxides. (Under the direction of Ralph Joseph McCracken).

Thomas Gill Miller, Physics, (January, 1965)
Dissertation: Neutron Polarization Measurements Using a Liquid Helium, Time-of-Flight, Coincidence Polarimeter. (Under the direction of Arthur Walter Waltner).

Harry Ballard Moore, Jr., Entomology, (August, 1964)
Dissertation: Observations on the Biology of *Xyletinus peltatus* (Harris) (Coleoptera, Anobiidae) with Notes on Morphology. (Under the direction of Clyde Fuhriman Smith).

Andi Hakim Nasoetion, Experimental Statistics, (January, 1965)
Dissertation: An Evaluation of Two Procedures to Estimate Genetic and Environmental Parameters in a Simultaneous Selfing and Partial Diallel Test Crossing Design. (Under the direction of Columbus Clark Cockerham).

Joel Von Perry, Electrical Engineering, (August, 1964)
Dissertation: An Analog Time Delay Unit. (Under the direction of George Burnham Hoadley).

Ludwig John Piening, Plant Pathology, (January, 1965)
Dissertation: Nature of Resistance and Pathogenesis in the Net Blotch Disease of Barley. (Under the direction of Teddy Theodore Hebert).

Clayton Eugene Posey, Forest Management, (August 1964)
Dissertation: The Effects of Fertilization on Some Wood Properties of Loblolly Pine (*Pinus taeda* L.). (Under the direction of T. Ewald Maki and Bruce John Zobel).

Harry Lothrop Powe, Physiology, (August, 1964)
Dissertation: The Effects of Removal of the Senses of Sight and Smell on the Reproductive Processes of the Albino Rat. (Under the direction of John A. Santolucito).

Walter Ray Prince, Animal Science, (January, 1965)
Dissertation: The Identification of a Natural Resistance Factor to *Salmonella gallinarum* in the Chicken. (Under the direction of Henry Wilburn Garren and Lester Curtiss Ulberg).

Wilbur Joseph Privott, Jr., Chemical Engineering, (January, 1965)
Dissertation: Analyses of Flow-Forced, Concentric Tube Heat Exchangers. (Under the direction of James K. Ferrell).

Thomas Gilmer Proctor, III, Applied Mathematics, (August, 1964)
Dissertation: Almost Periodic Solutions for Two Weakly Coupled Nonlinear Oscillators. (Under the direction of Raimond Aldrich Struble).

Richard Harvey Richardson, Genetics, (January, 1965)
Dissertation: A Study of Genetic Variations of Drosophila Fecundity by Analysis of Selection Responses. (Under the direction of Ken-ichi Kojima).

Jerry Allan Roberts, Applied Mathematics, (August, 1964)
Dissertation: Approximate Methods for the Solution of Certain Dual Fourier-Bessel Series Relations. (Under the direction of John Wesley Cell and Ian Naismith Sneddon).

William Hamilton Rowan, Jr., Civil Engineering, (January, 1965)
Dissertation: A Minimum Weight Study of Indeterminate Cover-plated Steel Beams. (Under the direction of Richard Hugh Bigelow and Charles Raymond Bramer).

Donald Henry Roy, Nuclear Engineering, (August, 1964)
Dissertation: Fundamentals of Neutron Transport Theory. (Under the direction of Raymond Le Roy Murray).

Frank Dorrance Sargent, Animal Science, (January, 1965)
Dissertation: Genetic and Environmental Influences on Fat and Solids-not-fat in Milk. (Under the direction of James Edward Legates).

Saad Abdo Shammoot, Soil Science, (January, 1965)
Dissertation: Nonharvested Contributions of the Growing Plant to the Soil Organic Matter and Some Mechanisms of Its Distribution in the Soil. (Under the direction of William Victor Bartholomew).

Ram Badan Singh, Genetics, (January, 1965)
Dissertation: Cytogenetic Studies in *Rumex acetosella* and Its Hybrids with *Rumex hastatulus* with Special Consideration of Sex Determination. (Under the direction of Benjamin Warfield Smith).

Joseph Smartt, Genetics, (January, 1965)
Dissertation: Cross-compatibility Relationships Between the Cultivated Peanut *Arachis hypogaea* L. and Other Species of the Genus *Arachis*. (Under the direction of Walton Carlyle Gregory).

Frederick John Smith, Agricultural Economics, (January, 1965)
Dissertation: An Analysis of Resource Combination, Cost and Revenue in Peach Harvesting and Packing: North Carolina Sandhills. (Under the direction of William Douglas Toussaint).

Michael Andrew Taras, Wood Science and Technology, (January, 1965)
Dissertation: Some Wood Properties of Slash Pine (*Pinus elliottii* Engelm.) and Their Relationship to Age and Height Within the Stem. (Under the direction of Eric Louis Ellwood).

Thomas Robert Terrill, Crop Science, (January, 1965)
Dissertation: Alkaloid Conversion in Tobacco. (Under the direction of Thurston Jefferson Mann).

Charles Donald Webb, Forest Management, (August, 1964)
Dissertation: Natural Variation in Specific Gravity, Fiber Length, and Interlocked Grain of Sweetgum (*Liquidambar styraciflua* L.) in the South Atlantic States. (Under the direction of Bruce John Zobel).

Martin Allan Welt, Physics, (January, 1965)
Dissertation: Ionic Wave Propagation in Plasmas. (Under the direction of Grover Cleveland Cobb, Jr.).

Elmo Benjamin Whitty, Soil Science, (January, 1965)
Dissertation: Influence of Width of the Fertilizer Band on Response of Burley Tobacco to Nitrogen and Phosphorus. (Under the direction of Charles Bernard McCants).

James Oliver Wise, Agricultural Economics, (August, 1964)
Dissertation: Policy Decisions for Promoting Economic Development in Low Income Areas. (Under the direction of William Douglas Toussaint).

Edward Hempstead Wiser, Agricultural Engineering, (August, 1964)
Dissertation: Persistence models in Precipitation Analysis. (Under the direction of Jan van Schilfgaarde).

Recipients of Honorary Degrees

LEONARD DAVID BAVER

Though DR. LEONARD DAVID BAVER was born and educated in Ohio, he is a Southerner by choice and adoption. The region is particularly fortunate that he devoted his active life to our land, for his contributions to scientific agriculture in the State and in the entire South, especially his pioneering achievement in Soil Science, have benefited all Americans. Few men have served this University so well in so many capacities: as Head of the Agronomy Department, as Director of the Agricultural Experiment Station, and finally, as Dean of the School of Agriculture. The development of agricultural research in North Carolina and the general elevation of the caliber of teaching and research in the School of Agriculture owe much to his foresight and leadership. As teacher, author, administrator, and scientist, he has set the highest standards of excellence, inspiring students and associates to realize the best within themselves. In 1946 he was selected by *The Progressive Farmer as* "Man of the Year" in North Carolina agriculture. Since Dr. Baver's academic retirement, he has been the distinguished Director of the Experiment Station of the Hawaiian Sugar Planters Association. In honoring him, North Carolina State honors one of its own. It is therefore a special privilege to bestow upon him today this degree.

CHARLES FRANCIS GOLDTHWAIT

Eminent teacher, inventor, scientist, and climber of mountains, CHARLES F. GOLDTHWAIT is a Yankee from Massachusetts who made his professional reputation in the land of cotton. Having served as Senior Cotton Technologist on the staff of the Southern Regional Research Laboratory and as Head of the Cotton Processing Section in the Agricultural Research Service, it was appropriate that upon his Federal retirement he became Professor of Textile Research at North Carolina State. Honored four times by the United States Department of Agriculture and winner of the coveted Olney Medal in 1962 for his notable achievements in the field of textile chemistry, he has been active in the textile industry more than fifty years. He has published over a hundred articles and research papers, written indispensable books, and guided numerous graduate students in his area of specialization. As a scientist of original imagination, Charles Goldthwait was one of the first to attempt and succeed in modifying cotton through chemical reactions. He was instrumental in the development of a semi-elastic gauze bandage widely used on the battlefields during World War II. In addition, his concept of "stretch" fabrics has helped to usher in a new era in textile manufacturing. We are glad that he delighted in mountain peaks—physical, mental, and spiritual—and North Carolina State takes delight now in honoring him.

JOHN HAROLD LAMPE

Chosen in 1945 to plan and carry out the post-war expansion of North Carolina State's School of Engineering, DR. JOHN HAROLD LAMPE effected an astonishing development of the School in terms of size, educational quality, and national importance. As its Dean for seventeen years, he guided its growth to the position of that of one of the largest in the nation, adding new instructional departments and new programs of research. His part in securing the nuclear reactor helped to make this University a pioneer in nuclear education. For undergraduates Dean Lampe developed a sound curriculum for every student and an Engineering Honors Program for the most talented, always insisting on the importance of the humanities and social sciences in a technical program. In addition, he aided the development of graduate programs and the establishment of projects of fundamental research in the major technological areas. Keeping abreast of technological advancements in a rapidly changing field, Dean Lampe looked ahead, with exceptional vision, to new advancements in technology and education. Vigorously and with dedication, he helped to bring these to North Carolina State—which now, proud of its School of Engineering, proudly and gratefully honors him.

JASPER LEONIDAS STUCKEY

When DR. JASPER L. STUCKEY was born in Johnston County, North Carolina, he was given a prophetic name; for jasper is a precious stone, and Dr. Stuckey has devoted his entire career to the study of North Carolina's minerals. As administrator, author, and scientist, he has for more than forty years thrown himself enthusiastically into the dual role of college teacher and public servant. In one role he founded the Department of Geology at North Carolina State, building it to a high degree of excellence, and aided in establishing our program in geological engineering. In his other role, as State Geologist in the Department of Conservation and Development, he contributed more than any other individual to the knowledge of North Carolina's mineral wealth and to the growth of our mineralogical industries, most notably in phosphate and tungsten. Under his direction of the Division of Mineral Resources, there was prepared and published the first modern geological map of North Carolina; and in large measure due to his leadership and promotion, mineral production in our State has tripled since 1940. North Carolina State hopes today to add new lustre to the name of Jasper L. Stuckey by bestowing on him an honorary degree.

Awards for Achievement

1964-1965

SCHOOL OF AGRICULTURE AND LIFE SCIENCES

Agricultural Economics:
Wall Street Journal Achievement Award: Frank L. Lancaster, Jr., Rocky Mount

Agricultural Engineering:
American Society of Agricultural Engineers, Student Honor Award: Roy Edward Young, Norlina
Senior Honor Award in Agricultural Engineering, Technology Program: Jerry Lassiter Causey, Grifton

Agronomy:
Senior Highest Scholastic Average in Agronomy: Henry Calvin Newton, Jr., Wagram (Plant Protection)
American Society of Agronomy Award, Most Outstanding Senior: John Paul Lilly, Troy (Soil Science)
Agronomy Club Leadership Award: John Paul Lilly, Troy (Soil Science)

Animal Science:
Fred M. Haig Trophy: Richard Joel Putnam, Shelby

Biological Sciences:
Phi Sigma Achievement Award: Henry Calvin Newton, Jr., Wagram (Plant Protection)

Food Science:
Virginia Dare Award: Tian-Ben Lao, Quezon City, Philippines
Forbes Chocolate Award: Frank Charles Briner, Kinston

Gamma Sigma Delta:
Sophomore Certificate: Mrs. Adelaide Clark Carpenter, Raleigh
Senior Certificate: Franklin F. Snelson, Jr., Richmond, Va.

Horticultural Science:
Outstanding Senior Award: Maurice W. Webster, Cary
Burpee Award: William R. Caudill, Washington, D. C.

SCHOOL OF DESIGN

American Society of Landscape Architects Certificate of Merit: Baxter Wayne Coulter, Raleigh
Aluminum Company of America Book Award: George Samuel Seegers, Charlotte
American Institute of Architects School Medal: Morris Edward Parker, Murfreesboro, Tennessee
American Institute of Architects Book Award: Laurin Barker Askew, Jr., Wilmington
Edgar R. Calloway Memorial Scholarship for Foreign Study: William Alvis Brogden, Sanford
Alpha Rho Chi Medal: William Alvis Brogden, Sanford
North Carolina Chapter of the American Institute of Architects Book Award: Wesley Milton Coble, Smithfield
Walter Hook Award: Stephen Bryant Griffin, Aiken, South Carolina

SCHOOL OF EDUCATION

Education Council Key, most outstanding student enrolled in: Agricultural Education, Coy Lynn Hudson, Concord; Industrial Arts Education, John Frink

Freeman, Jr., Bladenboro; Industrial Education, James Harry Rhea, Canton; Mathematics and Science Education, Robert Edward Cole, Greensboro; Recreation and Park Administration, James Ray Sellers, Lilesville

Agricultural Education Club Award: most outstanding senior: graduating at the end of the fall semester, William Joe Long, Ash; graduating at the end of the spring semester, James Bryan Brooks, Bath

Kappa Phi Kappa Scholarship Medal: James Bryan Brooks, Bath

SCHOOL OF ENGINEERING

The Hamilton Watch Award: William James Burgess, Stanley (Senior, Industrial and Textiles)

The School of Engineering Outstanding Senior Award: Robert Warren Downing, Winston-Salem (Senior, Electrical)

The Outstanding Engineering Citizen Award: Stephen Andrew Johnston, Concord (Senior, Nuclear)

Ceramic Engineering: J. C. Steele Upperclassman Scholarship: George L. Morelock, III, Raleigh (Senior, Ceramic); Moland-Drysdale Scholarship: Robert Andrew Lawhon, Carthage (Freshman, Ceramic)

Chemical Engineering: Eastern North Carolina Section of American Institute of Chemical Engineers Award to Outstanding Senior in Department: Norvin Aaron Clontz, Glen Alpine (Senior, Chemical); AICHE Student Chapter Award to Junior Member with Highest Academic Average: Michael Ray Overcash, Media, Pennsylvania (Junior, Chemical)

Civil Engineering: Associated General Contractors Award to Outstanding Senior in Construction Option: Michael Reid Norris, Wilmington (Senior, Civil Engineering Construction Option); North Carolina Section, American Society of Civil Engineers Awards to the Outstanding Seniors in Civil Engineering: James Ashley Aberson, Jr., Charlotte (Senior, Civil); Raymond Richard Avent, Jr., Newport News, Virginia (Senior, Civil); Walter Warren Miller, Jr., Idaho Falls, Idaho (Senior, Civil); James Lee Zimmerman, Jr., Lexington (Senior, Civil); North Carolina Chapter of the American Public Works Association Awards to Outstanding Seniors in Civil Engineering: James Thomas Jarrett, Asheville (Senior, Civil); Richard Slaughter Taylor, Goldsboro (Senior, Civil)

Electrical Engineering: Institute of Electrical and Electronics Engineers Outstanding Member: James Seawright Florence, Raleigh (Senior, Electrical); Institute of Electrical and Electronics Engineers Student Papers Contest: Robert Warren Downing, Winston-Salem (Senior, Electrical)

Industrial Engineering: Outstanding Sophomore in Industrial Engineering: Stephen Charles Smith, Albemarle (Sophomore, Industrial); Outstanding Senior in Industrial Engineering: Emory E. Enscore, Jr., Hampton, Virginia (Senior, Industrial); Outstanding Senior in Furniture Manufacturing and Management: Birger K. Rasmussen, Raleigh (Senior, Furniture Manufacturing and Management)

Mechanical Engineering: American Institute of Aeronautics and Astronautics Award to Outstanding Senior in Aerospace Engineering: Hilton Boyd Perry, Greensboro (Senior, Aerospace Engineering); American Society of Mechanical Engineers Certificate Award to Outstanding Senior Member of ASME Chapter: Marvin William Thompson, Winston-Salem (Senior, Mechanical); Pi Tau Sigma Award to Sophomore in Department with Highest Academic Average: Robert Mac Brunk, Charlotte (Sophomore, Aerospace Engineering)

Nuclear Engineering: Outstanding Senior in Department: Stephen Andrew Johnston, Concord (Senior, Nuclear)

SCHOOL OF FORESTRY

Xi Sigma Pi Senior Award: Donald Bruce Zobel, Raleigh

Xi Sigma Pi Freshman Award: Thomas Joseph Chastant, Mobile, Alabama

Continental Can Competitive Scholarship Awards: James Victor Henderson, Hopewell, Virginia; Andrew Stewart Nuckols, Rocky Mount; William Daniel

McGill, II, Lakeview; Charles L. Lennon, Bladenboro; Gregory Hudson Winston, Bumpass, Virginia; Jimmy Douglas Gregory, Angier; Samuel Buchanan Land, South Hill, Virginia

Homelite Honor Awards: Charles Joseph Duckworth, Brevard; Marvin Bob Hula, Charles City, Virginia

Biltmore Scholarship Awards: William Thomas Caroon, Poplar Branch; Douglas R. Phillips, West Jefferson; David W. Shepard, Salisbury

Slocum Scholarship Award: William Jefferson Wade, Jr., Henderson

Conger Scholarship Awards: Philip Griffin Connell, Charlotte; Fayette C. Wiatt, Gloucester, Virginia

Paper Industry Management Association Award: William Edward Bradford, Mt. Airy

SCHOOL OF LIBERAL ARTS

The Liberal Arts Council Award for the Outstanding Senior in Liberal Arts: Mrs. Irene Jones Gaskins, Raleigh (Senior, English)

B. F. Brown Award for Excellence in Liberal Arts: Philander Dean Chase, Raleigh (Senior, History)

Rudolph E. Freund Prize for Excellence in the Social Sciences: Mrs. Carolyn Lindh Ball, Raleigh (Senior, Politics)

SCHOOL OF PHYSICAL SCIENCES AND APPLIED MATHEMATICS

The Chemical Rubber Company Awards for Achievement in Freshman Chemistry: Patty Sue Greene, Boiling Springs; James Elmore Lowe, Winston-Salem; Harold Edward Sellers, Charlotte

The Merck Index Award for Scholastic Achievement in Chemistry: Ethel Marie Oliver, Cary

Award to top ranking State student in the William Lowell Putnam Mathematical Competition: Charles Newton Winton, Raleigh

SCHOOL OF TEXTILES

American Association of Textile Chemists and Colorists Award: Henry Walter Somers, Jr., Burlington

American Association for Textile Technology Award: William King Howle, Burlington

Harry Ball Award: Wayne Hugh Marshall, Colfax

Delta Kappa Phi Fraternity Award: Darrell Conrad Steagall, Leaksville

Saul F. Dribben Memorial Award: James Lindberg Parrish (In absentia), Bladenboro

Everett C. Drake Award: Grant Herbert Warner, Wilmington, Delaware

Alfred Hofmann Needle Works Award: David Wayne Craft, Cherryville

Laconia Cooper Sales Corporation Award: Joseph Speed Williams (In absentia), Greensboro

North Carolina Textile Manufacturers Association Award: Darrell Conrad Steagall, Leaksville

Phi Psi Fraternity Award: Stephen Barrett Duerk, Baldwin, New York

John M. Reeves Scholarship: Thomas Wayne Eggleston, Star

Harry Riemer Award: Stephen Barrett Duerk, Baldwin, New York

Chester H. Roth Award: George Robert Johnson, Wilmington

Sigma Tau Sigma Scholarship Fraternity Award: William James Burgess, Staley

Textile Forum Technical Journalism Award: Richard Edward Byrd, Jr., Bunnlevel

Textile Forum Technical Journalism Award: Darrell Conrad Steagall, Leaksville, N. C.

Textile Veterans Association Award: Joe Thomas Koontz, Salisbury

ALUMNI ATHLETIC TROPHY

Ronald Joseph Skosnik, McKees Rocks, Pennsylvania

PHI KAPPA PHI, NATIONAL HONORARY SCHOLARSHIP SOCIETY

Intellectual Achievement—Ph.D. Candidate: Major Mereland Goodman, Des Moines, Iowa

Intellectual Achievement—M.S. Candidate: Fred T. Ledig, New Brunswick, New Jersey

Highest Scholastic Standing—Seniors: Robert Gene Howell, Boone; Frank Lawrence Lancaster, Jr., Rocky Mount; Mary Hunter Schaub, Apex; Charles Joseph Steenburgh, Amsterdam, New York

Highest Scholastic Standing—Junior: Richard Michael Minday, Jr., Charlotte

Highest Scholastic Standing—Sophomore: Bryan Leslie Boulier, Raleigh

AIR FORCE ROTC AWARDS

Air Force Times Award of Merit: Cadet Lt. Col. Thomas E. Capps, Raleigh

Air Force ROTC Flight Leader Award: Cadet Capt. William A. Stephenson, Raleigh

Major General William C. Lee Scholarship Award: Cadet Thaddeus W. Shore, Boonville

Scabbard and Blade Award: Cadet M/Sgt. Alan N. Jackson, Raleigh

Air Force ROTC Best Drilled Cadet Awards: Cadet TSgt. Harvey L. Mangum, Roxboro; Cadet MSgt. John W. Dickey, Jr., Roseboro; Cadet Major Donald S. Pickard, Winston-Salem.

Daughters of the Founders and Patriots of America Medal: Cadet Donald G. Gaw, Raleigh

Chicago Tribune Gold Medal: Cadet Col. David J. Ivey, Montgomery, Alabama

Chicago Tribune Gold Medal: Cadet Capt. Joseph M. Kelley, Raleigh

Chicago Tribune Silver Medal: Cadet TSgt. Walter G. Gibson, Coffee, Georgia

Chicago Tribune Silver Medal: Cadet Norris L. Campbell, Greensboro

Armed Forces Communications and Electronics Association Award: Cadet Col. Richard C. Paschall, Jr., Jacksonville

American Legion Medal: Cadet Col. Daniel J. Golden, St. Johns, Pennsylvania

Sons of the American Revolution Medal: Cadet Ben A. Lassiter, Raleigh

Reserve Officers Association Honor Awards: Cadet Thomas E. May, Springfield, Virginia; Cadet MSgt. Milton F. Haas, Fayetteville; Cadet Lt. Col. Samuel B. Land, Jr., South Hill, Virginia

Reserve Officers Association Medal Award: Cadet Capt. Robert W. Morton, Raleigh

General Dynamics Cadet Award: Cadet SSgt. Ruffin B. Holder, II, Raleigh

Arnold Air Society Award: Cadet SSgt. Albert W. Addington, West Jefferson

Air Force Academic Achievement Awards: Cadet Capt. Robert W. Morton, Raleigh; Cadet Lt. Col. Samuel B. Land, Jr., South Hill, Virginia

Professor of Aerospace Studies Honor Squadron Award: Cadet Lt. Col. Richard S. Davis, Lumberton

ARMY ROTC AWARDS

The Department of the Army Superior Cadet Awards: Senior Class: Cadet Colonel Jimmy D. Gregory, Angier; Junior Class: Cadet Captain Clyde S. Overcash, China Grove; Sophomore Class: Cadet Corporal Charles S. Wolff, Raleigh; Freshman Class: Cadet Robert O. Triplett, Rutherfordton

Certificate of Meritorious Leadership Achievement: Cadet Colonel Jimmy D. Gregory, Angier

The Colonel John W. Harrelson Scholarship Award: Cadet James E. Carpenter, Richmond, Virginia

Association of the United States Army Medal: Cadet Captain Clyde S. Overcash, China Grove; Cadet Colonel Jimmy D. Gregory, Angier

Association of the United States Army Special Award: Cadet Staff Sergeant John A. Hawkins, Gastonia

American Ordnance Association Key Award: Cadet Major James D. Smith, Benson

Master Sergeant Horace C. Thomas, Sr. Award: Cadet Gary F. Andrew, Snow Camp

Best Drilled MS I Cadet Award: Cadet George M. Clendenin, Wilmington

Best Drilled Platoon Award: Cadet Captain Craven C. Morton, Jr., Albemarle.

Chicago Tribune Gold Medals: Cadet Major Donald W. Mackland, Fort Smith, Arkansas; Cadet First Sergeant Charles H. Lee, Jr., Wilson

Chicago Tribune Silver Medals: Cadet John D. Williams, III, Charlotte; Cadet Richard B. Evarts, Scotch Plains, New Jersey

Society of American Military Engineers Award: Cadet Captain Willard G. Preussel, Jr., Winston-Salem

The National Defense Supply Association Medal: Cadet Colonel Jimmy D. Gregory, Angier; Cadet Captain Clyde S. Overcash, China Grove

Armed Forces Chemical Association Award: Cadet Captain William F. Hunter, Clarksville, Virginia

American Legion Medal: Cadet Major Howard W. McAllister, Jr., Aurora, Illinois

Scabbard and Blade Excellence Award: Cadet Staff Sergeant George B. Butler, Dunn

Scabbard and Blade Marksmanship Award: Cadet Captain Phillip C. Stephens, Rocky Mount

Reserve Officers Association Honor Award: Cadet Lieutenant Colonel Michael R. Norris, Wilmington; Cadet Corporal Charles S. Wolff, Raleigh; Cadet Larry J. Modlin, Rocky Mount

Reserve Officers Association Medal: Cadet First Sergeant Neal S. Doby, High Point

Pershing Rifles Achievement Trophies: Cadet Second Lieutenant John C. Murdock, III, Troutman; Cadet Sergeant Ervin P. Bridges, Jr., Raleigh; Cadet Corporal Leotha Debnam, Jr., Raleigh

Sons of American Revolution Medal: Cadet First Sergeant Charles H. Lee, Jr., Wilson

Daughters of the Founders and Patriots of America Award: Cadet Staff Sergeant William O. Tyndall, Jr., Salemburg

Distinguished Military Musician Award: Cadet Staff Sergeant George F. Manska, Fayetteville

Armed Forces Communications and Electronics Association Award: Cadet Captain Gordan E. Shuford, Jr., Hickory

National Defense Transportation Association Award: Cadet Captain William M. Duncan, Jr., Wilkesboro

Professor of Military Science Award: Cadet Captain Leo I. Barker, Jr., Gastonia

OUTSTANDING TEACHER AWARDS

Each year the graduating seniors of the respective schools select a recipient for the senior Distinguished Class Room Teacher Award. From these school recipients, one individual is selected to receive the Outstanding Teacher Award, which is accompanied by a $500 check from the North Carolina State Alumni Association.

The awards are announced each year as a part of the Commencement exercises.

USAF ROTC Cadets Commissioned 1964-1965

TO BE COMMISSIONED ON 29 MAY 1965:

*Ammon, Robert V.	Statesville, North Carolina
Bell, Wayland K.	Faison, North Carolina
Boyce, Joseph B., Jr.	Manteo, North Carolina
*Bumgarner, Charles R.	Wilkesboro, North Carolina
Carver, Luther W., Jr.	Hudson, North Carolina
*Chapman, George W., Jr.	Charlotte, North Carolina
Davis, Richard S., Jr.	Lumberton, North Carolina
Etchells, James L.	Raleigh, North Carolina
Gillis, John M., Jr.	Fayetteville, North Carolina
Goddard, David M.	Raleigh, North Carolina
*Gray, Jerry W.	Winston-Salem, North Carolina
*Hill, David B., Jr.	Wadesboro, North Carolina
Hill, Walter W.	Murfreesboro, North Carolina
Humbert, Steven B.	Greenville, North Carolina
Hupko, Michael G.	Pinebluff, North Carolina
*Hyder, John H.	Lincolnton, North Carolina
*Ivey, David J.	Montgomery, Alabama
Jackson, Andrew R., Jr.	Lillington, North Carolina
*Jenkins, William A. III	Charlotte, North Carolina
*Jones, Johnny M.	Snow Hill, North Carolina
Keen, Russell L.	Four Oaks, North Carolina
*Land, Samuel B., Jr.	South Hill, Virginia
Miller, David K.	Baltimore, Maryland
Morris, Charles E.	Raleigh, North Carolina
*Mottern, Michael M.	Newport, North Carolina
*Paschall, Richard C., Jr.	Jacksonville, North Carolina
Peele, Donald G.	Stokes, North Carolina
*Warren, Joe B., Jr.	Newton Grove, North Carolina

COMMISSIONED ON 1 JULY 1964—30 APRIL 1965:

Basden, Bruce K.	Dudley, North Carolina
Bennett, Hugh J.	Lillington, North Carolina
Brown, Robert H.	Swannanoa, North Carolina
*Bourne, Robert B.	Raleigh, North Carolina
Cagle, Donald R.	Kannapolis, North Carolina
*Carey, John F.	Charlotte, North Carolina
Choplin, Larry E.	Winston-Salem, North Carolina
Church, David B.	Lenoir, North Carolina
Deal, Jesse M.	Kannapolis, North Carolina
Deal, Jimmy V.	Aurora, North Carolina
Foushee, John C.	Sanford, North Carolina
*Glosson, Buster C.	Greensboro, North Carolina
Grainger, John W. II	Clarendon, North Carolina
*Griffin, Charles B. III	Woodville, North Carolina
Helper, Wilson H.	Thomasville, North Carolina
Hill, Owen R.	Kannapolis, North Carolina
Hobgood, Henry M.	Stem, North Carolina
Johnson, Stephen F.	Smithfield, North Carolina
Jones, Walter B., Jr.	Raleigh, North Carolina

* Distinguished Graduate

Keech, Leo B.	Pantego, North Carolina
McConnell, Thomas H.	High Point, North Carolina
Price, Charles R.	Salem, North Carolina
Rabb, John F.	Marion, North Carolina
Rogers, Jerry W.	Kannapolis, North Carolina
*Thomas, Robert E.	Moncure, North Carolina
Williams, Brooks M.	Wilson, North Carolina
Woody, John W.	Leaksville, North Carolina

* Distinguished Graduate

Army ROTC Cadets Commissioned 1964-1965

TO BE COMMISSIONED ON 29 MAY 1965:

*Alexander, Moultrie M., Jr.	Decatur, Georgia
Andrews, Norman J.	Raleigh, North Carolina
Bailey, Thomas E.	Raleigh, North Carolina
*Barker, Leo I., Jr.	Gastonia, North Carolina
Boisky, Robert L.	Fort Bragg, North Carolina
Briner, Frank C.	Kinston, North Carolina
Brothers, Bryant T.	Elizabeth City, North Carolina
Coble, Wesley M.	Smithfield, North Carolina
Cron, Frederick H.	Bowie, Maryland
Day, Wayne T.	Roxboro, North Carolina
Dixon, Joseph III	Tampa, Florida
Duckworth, Charles J.	Brevard, North Carolina
*Duncan, William M., Jr.	Wilkesboro, North Carolina
Dwore, Donald J.	Schenectady, New York
Edgerton, Eric R., Jr.	Kenly, North Carolina
Farless, Lathan H.	Colerain, North Carolina
Forrest, Lewis C., Jr.	Newport, North Carolina
George, Harvey W.	Greensboro, North Carolina
*Gregory, Jimmy D.	Angier, North Carolina
Gurley, David E., Jr.	Goldsboro, North Carolina
Hair, Henry A., Jr.	Mount Airy, North Carolina
*Harrell, Sam P., Jr.	Wadesboro, North Carolina
Harris, Thomas G., Jr.	Roanoke Rapids, North Carolina
*Harrison, Robert C.	Williamsburg, Virginia
Hege, Robert III	Lexington, North Carolina
Honaman, Justin C.	Glen Ridge, New Jersey
Hunter, William F.	Clarksville, Virginia
*Hurst, Raebourne B., Jr.	Winston-Salem, North Carolina
Jefferies, Jonathan	Peoria, Illinois
Johnson, Albert G.	Conover, North Carolina
Kann, Donald R.	Baltimore, Maryland
*Kennedy, Arthur L.	Kinston, North Carolina
*King, William	Florence, South Carolina
Lail, Rupert C., Jr.	Hickory, North Carolina
Lanier, Douglas T.	Wilmington, North Carolina
Lasley, Jansen B.	Lancaster, South Carolina
*Leinster, Joseph A., Jr.	Raleigh, North Carolina
Liner, Harry L. III	Waynesville, North Carolina
*Livingston, John C.	Charlotte, North Carolina
Marshall, William E., Jr.	Raleigh, North Carolina
Martin, Levon	Kannapolis, North Carolina
*May, Robert W.	Farmville, North Carolina
*McAllister, Howard W., Jr.	Aurora, Illinois
McDonald, Arthur R., Jr.	China Grove, North Carolina
McGee, Hal S.	Swan Quarter, North Carolina
McGraw, James R.	Winston-Salem, North Carolina
Melton, Braxton B.	Morganton, North Carolina
Moore, Richard H.	Spring Lake, North Carolina
*Morrison, White H. III	Nashville, Tennessee

* Distinguished Graduate

*Norris, Michael R. — Wilmington, North Carolina
*Ogburn, Wade L. — Roanoke Rapids, North Carolina
Perkinson, Frank D. — Wise, North Carolina
Powell, Robert C., Jr. — Asheville, North Carolina
Preussel, Willard G., Jr. — Winston-Salem, North Carolina
Pritchard, John S. — West Point, Virginia
*Rasmussen, B. K. W., III — Raleigh, North Carolina
Rhodes, Glenn G., Jr. — Matthews, North Carolina
Riddick, William S., Jr. — Elizabeth City, North Carolina
Shelton, Johnny D. — Albemarle, North Carolina
*Shuford, Gordon E., Jr. — Hickory, North Carolina
*Smith, James D. — Benson, North Carolina
Stoudemire, Stewart M. — Lincolnton, North Carolina
Taylor, Warren E., Jr. — Chesapeake, Virginia
Tulluck, William E., Jr. — Orangeburg, South Carolina
Vance, John F., Jr. — Kernersville, North Carolina
Wallace, Ralph T. — Cameron, North Carolina
Watford, Gary C. — Thomasville, North Carolina
Wiltshire, Robert A., II — Chevy Chase, Maryland
Yarbrough, John W. — Winston-Salem, North Carolina
Yasinsac, Andrew, Jr. — Sparta, North Carolina

COMMISSIONED ON 1 JULY 1964—30 APRIL 1965:

Brackett, Douglas A. — Charlotte, North Carolina
Braddock, James W. — Morganton, North Carolina
Buchanon, John R. — Boone, North Carolina
Bumgardner, Larry T. — Stanley, North Carolina
Card, Jones C. — Raleigh, North Carolina
Durrett, Van D., Jr. — Tampa, Florida
Edwards, John M. — Charlotte, North Carolina
Fountain, Jefferson L. III — Raleigh, North Carolina
Hooper, John W., III — Reidsville, North Carolina
Johnson, William F. — Oxford, North Carolina
Keller, James J. — Somers Point, New Jersey
Long, Michael H. — Mooresville, North Carolina
Matuza, George A. — Hempstead, New York
Moore, Richard K. — Alexandria, Virginia
Murray, Harry L. — Charlotte, North Carolina
Pope, Michael L. — Charlotte, North Carolina
Rutledge, James R. — Statesville, North Carolina
Swain, Thomas T., Jr. — Burlington, North Carolina
Tate, Charles A., Jr. — Boiling Springs Lake, North Carolina

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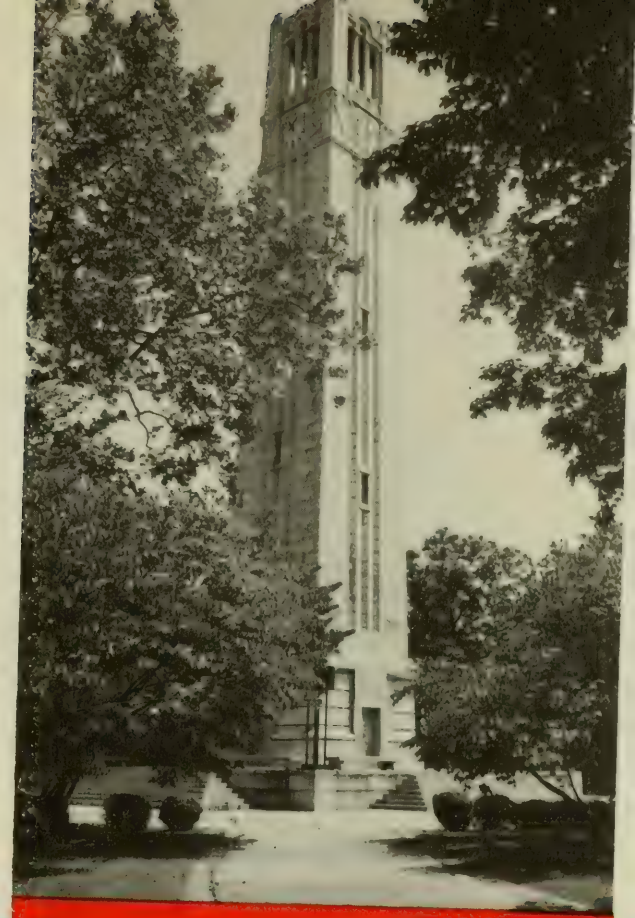
* Distinguished Graduate

NORTH CAROLINA STATE RECORD



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"CONTINUING HIGHER EDUCATION . . ."

NORTH CAROLINA STATE
of the University of
North Carolina at Raleigh

1965

SUMMER SESSIONS RECORD EDITION

NORTH CAROLINA STATE RECORD

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VOL. 65, NUMBER 1 **FEBRUARY 1965**

"Continuing Higher Education . . ."

. . . Summer Sessions

. . . Home Study Courses

. . . Short Courses & Conferences

. . . Night Classes

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Walter J. Peterson ..... *Dean of the Graduate School*

ADMISSION AND REGISTRATION

Kenneth D. Raab, B.A., M.A. ..... *Director*

NORTH CAROLINA STATE

North Carolina State of the University of North Carolina at Raleigh, founded by legislative act on March 7, 1887, first opened its doors to students on October 3, 1889. Since that time, the enrollment has grown from 45 to over 9,000 and the faculty has increased from 6 to approximately 1,000. In 1931, the State's Land Grant College and technological center became part of the University of North Carolina and has since operated as part of a triumvirate that now numbers some 25,000 students.

The major objective of North Carolina State is to provide an opportunity for students to obtain the highest level of scientific and technological training and, concurrently, to offer them facilities for obtaining a broad and general education. In order to achieve this end, North Carolina State is organized into eight major instructional divisions or schools: Agriculture and Life Sciences, Design, Education, Engineering, Forestry, Liberal Arts, Physical Sciences and Applied Mathematics, and Textiles, offering undergraduate work in 52 departments. Through the Graduate School, N. C. State provides instruction in some 40 fields leading to the master's degree and in 30 fields leading to the degree of Doctor of Philosophy. The general objectives of the University are also carried out through several institutes and divisions, including the Institute of Statistics, the Agricultural Experiment Station with its 16 tes farms, the Agricultural Extension Service, and the General Extension Division.

Division of General Extension

The Division of General Extension offers to the people of the State and the region a comprehensive program of adult education courses in three areas—short courses, extension night classes and correspondence.

The division conducts more than 100 short courses and conferences during the year on a variety of subjects; it offers a series of extension night classes (credit and non-credit) in areas across the state; and provides home study courses for persons who wish to further their education by working at home.

The short courses and conferences range to a variety of interest areas from the Cattlemen's Conference to the Conference on the Role of Grain Boundaries and Surfaces in Ceramics.

These adult education programs fall into general interest areas such as engineering, textiles, recreation and parks, agricultural, education and several others which are classified separately such as the N. C. Truck Driver Training School.

Extension night classes are offered on the University campus (non-credit) and there is an evening college program through the Admissions Office. Credit courses are offered in other sections of the state with the largest concentration being at Ft. Bragg where the University operates a degree-granting branch.

The home study program is operated mainly for the students on campus but is open to any persons who either wishes credit for transfer to another college for personal betterment. The Correspondence Bureau has a listing of approximately 75 course, mostly at the freshman and sophomore level.

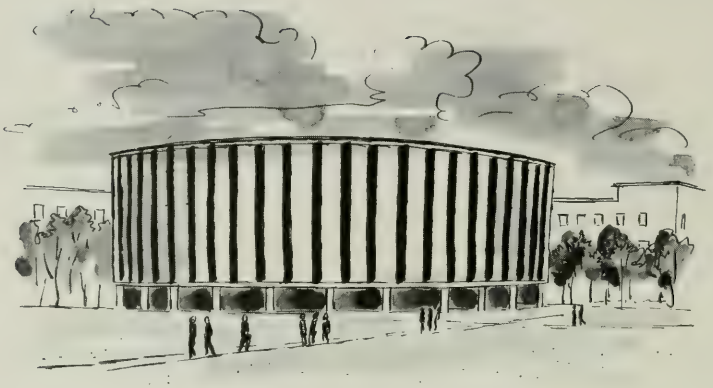
The division also currently operates Gaston Technical Institute at Gastonia, N. C. which is a two-year school, training technicians in four areas of engineering technology—civil, electrical, electronic and mechanical and production. This will become part of the community college system in July.

The Summer Sessions

The Summer Sessions at North Carolina State offer an extensive and varied program to fit the educational needs of more than 6,000 students. Fifty departments, with a faculty of almost three hundred, offer work in some three hundred courses, one-third of which are in the area of graduate study and research. Each of State's eight schools provides facilities for summer study; six of the schools offer courses during each of the regular six-week sessions; the School of Design maintains a nine-week program; the School of Forestry conducts a summer camp for sophomores as well as two five-week practicums, and Agricultural Extension offers a three-week program for Extension workers. In addition, special programs and institutes are provided by various departments.

Summer courses and special programs are designed for the undergraduate who wishes to advance his academic standing at N. C. State, for the graduate who needs to continue his study and research during the summer months, for visiting students working toward degrees at other institutions, for teachers earning credit toward the renewal of their certificates or toward advanced degrees in teacher education, and for persons in professional fields who wish to keep abreast of new development and trends. In addition, the Summer Sessions offers the high school student planning to enroll in N. C. State an opportunity to take required sub-college level work in English and mathematics.

In keeping with the growing emphasis on science, the 1965 Summer Sessions have continued to increase the regular offerings in sciences and have established one of the most comprehensive graduate and undergraduate programs in mathematics and physics available in the Southeast. To meet the needs of a broad, liberal education in the humanities and social sciences, new summer courses have been added in economics, English, history, music, political science, psychology, and sociology. The demand for professional and technical training has been met, not only through the regular summer offerings, but by augmented programs in engineering and textiles. Extensive undergraduate and graduate training has been provided in selected areas of Education, and a comprehensive graduate program has been maintained in the agricultural sciences.



Summer Sessions

1965

North Carolina State
of the University of North Carolina
at Raleigh

1965
CALENDAR

First Session

June 11	Friday	New student orientation.
June 14	Monday	Registration and payment of fees. Late registration fee of $5 payable by all who register after 1:00 p.m.
June 15	Tuesday	First day of classes.
June 18	Friday	Last day for registration. Last day to withdraw with refund less $7 registration fee, and last day to drop courses without grades.
July 20	Tuesday	Last day of classes.
July 21	Wednesday	Final examinations.

Second Session

July 21	Wednesday	New student orientation.
July 22	Thursday	Registration and payment of fees. Late registration fee of $5 payable by all who register after 12:00 noon..
July 23	Friday	First day of classes.
July 29	Thursday	Last day for registration. Last day to withdraw with refund less $7 registration fee, and last day to drop courses without grades.
August 26	Thursday	Last day of classes.
August 27	Friday	Final examinations.

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FACULTY FOR THE 1965 SUMMER SESSIONS

Donald B. Adcock, M.A.—Assistant Director of Music Activities

E. M. Afify, Ph.D.—Visiting Assistant Professor of Mechanical Engineering

F. J. Allred, M.A.—Associate Professor of Modern Languages

Michael Amein, Ph.D.—Assistant Professor of Civil Engineering

C. A. Anderson, Ph.D.—Professor and Head of Industrial Engineering

Charles N. Anderson, M.S.—Instructor of Mathematics

Roy N. Anderson, Ph.D.—Head of Department of Occupational Information and Guidance and Professor of Education

F. B. Armstrong, Ph.D.—Associate Professor of Genetics

Leonard W. Aurand, Ph.D.—Professor of Food Science

Robert Aycock, Ph.D.—Professor of Plant Pathology

T. S. Baldwin, Ph.D.—Assistant Professor of Psychology

E. A. Ball, Ph.D.—Professor of Botany and Bacteriology

S. T. Ballenger, M.A.—Associate Professsor of Modern Languages

W. E. Ballinger, Ph.D.—Associate Professor of Horticultural Science

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Key L. Barkley, Ph.D.—Professor of Psychology

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Burton F. Beers, Ph.D.—Associate Professor of History and Political Science

Norman R. Bell, M.S.—Associate Professor of Electrical Engineering

Thomas A. Bell, M.S.—Associate Professor of Food Science

Lawton E. Bennett, M.A.—Instructor of History and Political Science

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P. E. Blank, Jr., M.A.—Instructor of English

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C. H. Bostian, Ph.D.—Professor of Genetics

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L. H. Bowen, Ph.D.—Assistant Professor of Chemistry

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Herbert Brantley, M.A.—Instructor of Recreation and Park Administration

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George O. Doak, Ph.D.—Professor of Chemistry

D. W. Drewes, Ph.D.—Assistant Professor of Psychology

J. W. Dudley, Ph.D.—Research Associate Professor of Crop Science

J. W. Duffield, Ph.D.—Professor of Silviculture

P. J. Dyson, Ph.D.—Assistant Professor of Forestry and Agricultural Extension

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Don E. Ellis, Ph.D.—Head of Department and Professor of Plant Pathology

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Lowell W. Nielsen, Ph.D.—Professor of Plant Pathology

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E. M. Schoenborn, Ph.D.—Head of Department and Professor Chemical Engineering

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William D. Toussaint, Ph.D.—Professor of Agricultural Economics

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Hedwig H. Triantaphyllou, Ph.D.—Associate Professor of Plant Pathology

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T. N. Walters, M.A.T.—Instructor of English

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George C. Watson, M.A.—Associate Professor of Mathematics

J. B. Weber, Ph.D.—Assistant Professor of Crop Science

F. L. Wellman, Ph.D.—Visiting Professor of Plant Pathology

E. A. Wernsman, Ph.D.—Assistant Professor of Crop Science

J. A. Weybrew, Ph.D.—William Neal Reynolds Distinguished Professor of Plant Chemistry

R. Benjamin White, M.A.—Assistant Professor of English

Raymond C. White, Ph.D.—Professor of Chemistry

D. C. Whitenberg, Ph.D.—Research Assistant Professor of Crop Science

Donald Whiteside, M.S.—Instructor of Sociology and Anthropology

L. A. Whitford, Ph.D.—Professor of Botany and Bacteriology

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Talmage B. Young, D.Ed.—Associate Professor of Industrial Arts

B. J. Zobel, Ph.D.—Edwin F. Conger Distinguished Professor of Forest Genetics

C. F. Zorowski, Ph.D.—Professor of Mechanical Engineering

ADMISSION AND REGISTRATION

Students are admitted to the Summer Sessions in one or four categories: (1) new freshmen; (2) new undergraduate transfer students; (3) new graduate students; and (4) summer visitors. Every applicant must complete an application form; to keep from paying late registration fees and to avoid confusion, students should submit applications at least two weeks prior to the beginning of the session for which application is being made.

NEW FRESHMEN

Applications form for new freshmen should be obtained from the Director of Admissions, Peele Hall.

A new freshmen applicant should be a graduate of a high school and should have completed 16 units, ten of which should be distributed as follows:

4 units of English
2 units of Algebra
1 unit of geometry
1 unit of United States History
2 units of Science

The remainder of the units will be accepted from other courses, except that not more than one unit will be accepted from activity courses.

New freshmen applicants must take the Scholastic Aptitude Test of the College Entrance Examination Board and have their scores submitted to the Office of Admissions. Information and applications may be obtained by writing to the College Entrance Examination Board, Box 592, Princeton, New Jersey. Scores on the Scholastic Aptitude Test, together with the high school record, will be considered in determining admissibility.

NEW TRANSFER STUDENTS

In addition to submitting an application form which may be obtained from the Director of Admissions, Peele Hall, all transfer students must have official transcripts sent to the Office of Admissions directly from each other college attended.

All applicants for transfer must have an overall "C" average on prior college work and must be eligible to return to the last institution attended.

Transfer students with less than 29 semester hours of transfer credit must also follow the criteria for entering freshmen as outlined above.

GRADUATE STUDENTS

All students working toward advanced degrees are enrolled in the Graduate School. **An application for Graduate School admission may be obtained from the Dean of the Graduate School, Peele Hall.**

SUMMER VISITORS

A summer visitor is one who is attending North Carolina State during the summer, but who has *not* applied to be a regularly enrolled student working towards a degree. Teachers who are renewing their certificates and undergraduate students from other colleges are two groups of students who often enroll in this category. **An application for admission as a summer visitor should be obtained from the Director of the Summer Sessions, Peele Hall.**

READMISSION

Former North Carolina State students wishing to attend the Sum-Sessions should apply for readmission by writing to the **Director of Admissions and Registration for the appropriate form prior to May 31.**

PRE-REGISTRATION

Currently enrolled North Carolina State students should indicate their intentions to attend the Summer Sessions by making application at the Summer Sessions Office, Peele Hall between April 26 and May 7.

REGISTRATION

Registration for the First Session for all students will be held at the Reynolds Coliseum on Monday, June 14, from 8:30 A.M. to 1:00 P.M. Permits for registration should be picked up first at the Craft Shop in the basement of the Frank Thompson Theater east of the Coliseum starting at 8:30.

Registration for the Second Session for all students will be held at the Reynolds Coliseum on Thursday, July 22, from 8:30 A.M. to 12:00 noon. Permits for registration should be picked up first at the Craft Shop in the basement of the Frank Thompson Theater east of the Coliseum starting at 8:30.

SPECIAL NOTES

1. Tuition and fees are payable by check or cash on the day of registration. Please have the necessary funds with you.

2. All students planning to take courses in both sessions should plan their sequences well in advance. Offerings in the Second Session are often substantially less in number than in the first, and, in many instances departments do not offer courses in both sessions of the summer school.

3. Everything possible will be done to ensure that the courses listed in this catalog are given at the times indicated. The Director of the Summer Sessions reserves the right, however, to withdraw courses in which the enrollment is deemed insufficient.

4. MAXIMUM CREDIT HOURS—The normal load for either session of the Summer Sessions is six semester hours. Any student may carry less. Loads in excess of seven hours must be approved by the Dean or Director of Instruction of the school in which the student is registered. Such approvals must be in writing on the original copy of the students Summer Session roster of courses. Visiting students must have their rosters signed by the Director of the Summer Sessions. The maximum load is nine hours for any one session.

EXPENSES

The following expenses apply for each of the regular six-week sessions:

TUITION	$ 7.50 per semester credit for North Carolina students. $18.50 per semester credit for out-of-state students. $ 7.50 for each credit hour audited.
FEES	$17.00 for registration and other fees. (A late fee of $5.00 will be charged all students completing their registration after the designated time.)
ROOM	$36.00 per person (two per room).
BOARD	Board is cafeteria style and the cost depends upon the individual student. A fair estimate would be about $75.00 per session.
GRADUATION FEE	Any student who is completing requirements for graduation at the close of one of the Summer Sessions will be charged a fee of $9.00 if he is securing a Bachelor's degree, a fee of $12.00 if he is completing work for a Master's degree, and a fee of $17.00 if he is a candidate for the degree of Doctor of Philosophy. The Graduate School will also charge Doctor of Philosophy candidates a fee of $21.00 for microfilming and mailing disertations.

Refunds

Tuition and Fees:

A student who withdraws from school on or before the last day for registration will receive a refund of the full amount paid, less $5 registration fee. On later withdrawals no refund is made.

Room Rent:

If a student vacates his room on or before the last day for registration, the rent paid will be refunded less the $5.00 room reservation fee or a charge of $1.00 per day, whichever amount is greater, from the first day of the registration period to the date of cancellation. After the last day for registration, no refund will be made for any reason other than official withdrawal from school. In such cases, the rent paid will be refunded, less a charge of $1.00 per day from the first day of the registration period to the date of cancellation. Room and mail box keys must be returned to the Housing Rental Office before refund of rent will be made. No key deposit required. Occupants not returning keys at end of rental period are assessed a charge of $5.00.

RESIDENCE HALLS

BRAGAW Hall and Lee Hall, the new nine-story residence hall, will be available for occupancy during the Summer Sessions. Accommodations will be provided for both men and women during each of the regular sessions. Bed linen, blankets and pillows are not furnished; however, linen rental service is available at a cost of $5.00 for each regular Summer Session. Students will normally be housed two in each room. Janitorial service, supplied by the University, does not include the making of beds. Single rooms are not available.

A card for requesting a residence hall room for the regular Summer Sessions and line rental service will be found among the cards mailed to applicants for admission—instructions on both sides of the residence hall card should be noted.

Residence halls are supervised by counselors, employed to assist residents, develop and maintain satisfactory study conditions, enforce University regulations, and ensure proper use of University facilities.

University housing regulations are posted in each room. It is each occupant's responsibility to read and comply with residence hall regulations. Failure to do so may result in extra charges or disciplinary action.

Persons attending *special* summer programs, such as, Agriculture Extension and other special groups, should contact the director of their particular program for housing information.

LINEN RENTAL SERVICE

This is an additional service the University is offering this year. The service provides an initial issue of line—two sheets, one pillow case, three bath towels, and a complete change each week during the Summer Session. Students using this service need not purchase or bring these items. The service is available to all students at a cost of $5.00 per Summer Session. Application for this service is included on the residence hall room reservation card and should be mailed to the Office of Business Affairs.

THE LIBRARY

The D. H. Hill Library of North Carolina State houses a collection of more than 310,000 volumes of books and bound journals. The collection has been developed to reflect the scientific and technical interests of N. C. State but materials in the arts and social sciences are also well represented. The Library subscribes to more than 4,200 current periodicals and contains over 21,000 bound volumes of documents from the Federal Government and the various Experiment Stations. The Library has been designated as one of the depositories for all unclassified publications of the Atomic Energy Commission and receives on exchange the publications of many foreign countries—especially those publications dealing with the agricultural sciences and with engineering.

A new, modern library building provides shelving for 400,000 volumes. Study carrels, conference rooms, and seminars are available for the students and faculty of N. C. State. Equipment for the production of photographic copies and for microphotography is available and there is excellent equipment on hand for reading microfilms and microcards.

Students and faculty will find the Library a useful and enjoyable adjunct to their Summer Sessions program, and will find the materials and services afforded to scholar, student, and browser a welcome discovery.

Library hours for the Summer Sessions are as follows:

Monday through Friday, 8:00 A.M. to 10:00 P.M. and Saturday, 8:00 A.M. to 1:00 P.M.

ERDAHL-CLOYD UNION

The center of summer activity is the Erdahl-Cloyd Union, one of the nation's most modern campus centers. All students on the campus are members and are invited to attend, free of charge, all programs sponsored by the Summer Sessions committee. Every member is welcome to join the committee and take part in planning the Union program.

During the summer, the Union sponsors a variety of entertainment. Activities will include parties, dances, movies, and a varied program of professional entertainment.

The completely air-conditioned Union offers many facilities and services to members and their guests. Facilities for recreation and leisure include a music-listening lounge, a television lounge, a gallery for the display of art and craft, a library lounge and a billiard room. Services include a barber shop, cloak room, snack bar, dining room, hotel rooms and meeting rooms.

Building hours are:

Monday-Saturday	7:00 A.M. to 11:00 P.M.
Sunday	4:30 P.M. to 11:00 P.M.

NEW BUILDINGS

The varied programs offered in the Summer Sessions are being enhanced by the addition of new structures on the campus.

The huge William D. Carmichael Gymnasium houses such gymnasium facilities as a swimming pool, 25 meters by 25 yards in size; 10 four-wall handball courts; six squash courts; and games area. In addition, the building provides space and equipment for wrestling, boxing, weight-lifting, and other gymnastics, a golf room and a correctives room.

The ultra-modern Student Supply Store offers books to whet diversified appetites. The reading material ranges from 25-cent paperbacks to the latest engineering encyclopedia. The spacious store, which contains 21,000 square feet, is completely air-conditioned.

Bragaw is one of the most modern residence halls on any campus. All corridors in this well-designed building are on the outside. They open into suites, each with accommodations for eight students. The building includes a counselor's office, student lounges, recreation rooms, mail rooms, a laundry station, and a snack bar.

Lee Hall, a nine-story residence hall, will be available for the 1965 Summer Sessions—Room and suite arrangement is similar to Bragaw Hall.

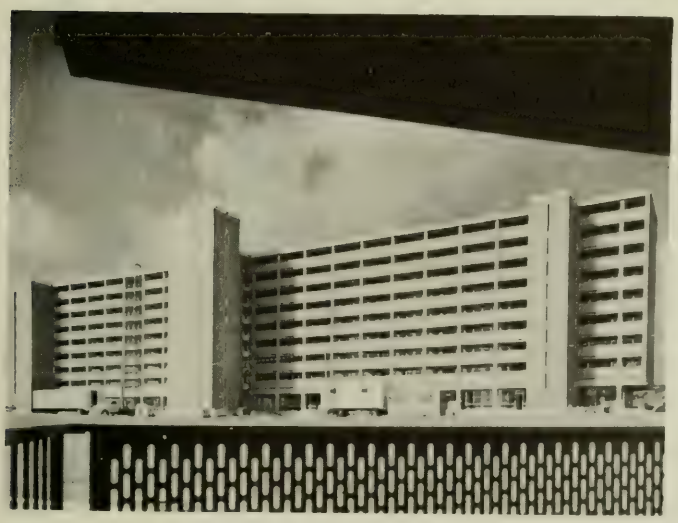
Harrelson Hall offers something new and different in classroom buildings; it is a circular structure, approximately 206 feet in diameter. Colossal Harrelson Hall accommodates 4,500 students at a time in classes ranging from 30 to 200 students. More than half of the Summer Sessions' classes will be taught in this modern, air-conditioned building.

General Laboratories Building is primarily for the use of statistics and physics. This new seven-story building adjoins Harrelson Hall.

Twelve modern fraternity houses make up the "new fraternity row" at North Carolina State. The entire complex houses 480 students.

Occupied during the latter part of December, 1963, Mann Hall is the new home of civil engineering. It was designed specifically for this area of study and research.

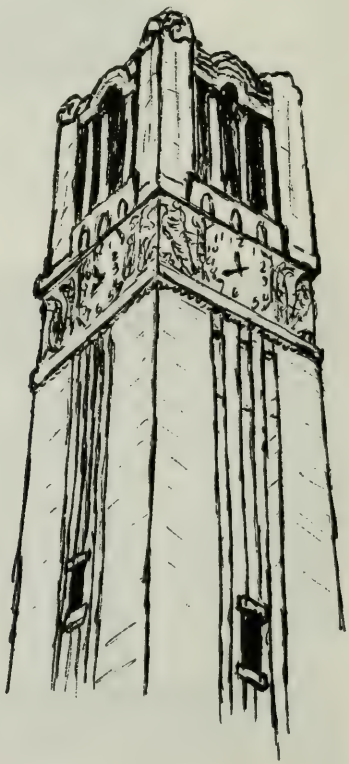
The L-shaped addition to Polk Hall was completed and occupied in 1963. It is the new home of Animal Science of the School of Agriculture and Life Sciences.



PART-TIME EMPLOYMENT

Part-time employment is often available in Raleigh and vicinity during the summer for those willing to do whatever work is called for or for those having certain skills. While job opportunities for young men are fairly good, opportunities for women students are limited. No student should depend on earning enogh money to cover tuition and living expenses, however. Because of less crowded class schedules, competition for the available jobs is much keener than during the regular term. Moreover, many campus agencies that hire a number of student workers during the year require less staff in the summertime due to the decreased enrollment.

The Student Employment Office, which operates as an integral part of the Finincial Aid Office, receives job orders from various sources on the campus and in Raleigh. The jobs more commonly listed with this office in recent summers have been in the following areas: gardening, clerical, house cleaning, waiters, laboratory and tutoring. N. C. State cannot attempt to assign jobs in advance of registration. After that time students should visit the Student Employment Office, 205 Peele Hall, and consult the list of current job openings.



DIRECTORS OF SPECIAL PROGRAMS AND ACTIVITIES

AGRICULTURAL EXTENSION
Fred S. Sloan — *Program Planning* — 109 Ricks Hall

ERDAHL-CLOYD UNION
Henry Bowers — *Director* — 216 Erdahl-Cloyd Union

COUNSELING
Lyle B. Rogers — *Director* — 205 Peele Hall

LIBRARY
I. T. Littleton — *Acting Director* — 130 D. H. Hill Library

RELIGIOUS ACTIVITIES
Oscar B. Wooldridge — *Coordinator* — Y. M. C. A.

RESIDENCE HALLS
James S. Fulghum, Jr. — *Housing Rental Officer* — Leazar Hall

STUDENT ACTIVITIES
Banks C. Talley, Jr. — *Director* — 204 Peele Hall

STUDENT HEALTH SERVICE
Dr. Joseph J. Combs — Clark Hall

STUDENT HOUSING
Norbert B. Watts — *Director* — 203 Peele Hall

TELEVISION
George Hall — *Director* — WUNC-TV Building

Special Institutes

INDUSTRIAL ARTS WORKSHOP—SPECIAL COURSES

Two workshops and a special course will be featured in the industrial arts summer sessions offerings. During the first session a course in New Developments in Industrial Arts Education and a workshop for Teachers of Mentally Retarded will be offered. The first course is designed to assist teachers and supervisors in keeping up with new approaches and new developments in teaching industrial arts in the public schools. It will help them to up-date their programs. A limited number of $50 scholarships will be available to teachers interested. The second course is a workshop consisting of planned industrial arts activities designed to assist the teachers of mentally retarded students.

A three-weeks workshop will also be offered during the last half of the second session. This concentrated course is designed to give the average teacher knowledge, skill, and confidence in planning and putting into operation and effective unit of electricity-electronics at the general shop level. Teachers with previous experience in the area of electricity should be able to organize and teach a unit course at the high school level. Special equipment will be made available from several manufacturers of the latest electronics teaching systems.

Each of the above courses carry three hours credit and may be taken for graduate or advanced undergraduate credit.

SUMMER READING WORKSHOP

The annual Summer Reading Workshop sponsored by the School of Education will provide a reading improvement section for entering college students during the *First Session.* Scores on college entrance tests indicate that a number of incoming freshmen could benefit from training in the improvement of reading rate, comprehension, and vocabulary building.

Entering college students who are interested in registering for this training should contact Dr. Paul Rust (Tompkins 212), Director of the Reading Workshop. The Workshop will meet hourly sessions on Monday, Wednesday, and Friday mornings.

DEPARTMENT OF EXTENSION PERSONNEL DEVELOPMENT SPECIAL SUMMER PROGRAM IN ADULT EDUCATION
June 28-July 16

The Department of Extension Personnel Development offers a special summer program of instruction at the graduate level for Extension workers and other Adult Educators. The program is designed to provide Adult Educators with the opportunity to bolster their understanding of the adult and society, the theories of learning,

social action, group processes, communications and planning requisite to effecting change among people.

The program is an interdisciplinary approach which utilizes the professional competence of a permanent and associate faculty. The program content encompasses theories and concepts which have applicability to all Adult Education organizations. Courses taught are in three major categories: (1) Adult Education, (2) Behavioral and Social Sciences, and (3) Natural Sciences.

Persons participating in this program will be enrolled in the Department of Extension Personnel Development. Six, three-credit courses will be offered. Each participant will take only one course. Persons desiring graduate credit may register as a "graduate special" or make application for admission to the Graduate School.

Detailed information concerning course offerings, graduate credit, registration and housing may be obtained by writing to Dr. Robert J. Dolan, State Leader of Training, 109 Ricks Hall, N. C. State, Raleigh.

The following courses will be offered:

AGC 403 Family Economics
AGC 521 Procurement, Processing and Distribution of Agricultural Products
AGE 332 Farm Structures
AGE 411 Farm Power & Machinery
CS 414 Weeds and Their Control
ED 593 Special Problems (in teaching)
EPD 503 The Programming Process in Adult Education
EPD 559 The Principles of Adult Education
EPD 590 Special Problems
PO 402 Commercial Poultry Enterprises
SOC 501 Leadership

INSTITUTE IN BIOLOGY FOR HIGH SCHOOL TEACHERS
June 14-July 23

The Department of Science and Mathematics Education and the Institute of Biological Sciences are offering a program of advanced instruction for high school teachers of biology. The Summer Institute is sponsored by the National Science Foundation and is intended to prepare the participants for the teaching of modern biology in the high schools.

The major part of the program will consist of two new courses developed especially for the Institute: (1) Foundations of Modern Biology; (2) Foundations of Microbiology. These two courses will give emphasis to major biological concepts, an understanding of which will be necessary for the development and teaching of a modern high school biology course. Another important feature of the Institute will be the Evening Lecture Series. Each week an outstanding scientist will present an evening lecture on a current topic in basic and applied biology. This Institute will stress the association of the teacher with a research environment that can be illustrated by the faculty, courses, and seminars, and it is hoped that this can then be trans-

mitted to the high school students. Those individuals selected to attend will be highly screened and emphasis in selection placed on the likelihood that they will pursue the necessary advanced study to become effective in modernizing the biology teaching in the high school curriculum. Graduate credit will be allowable in the two courses to be offered in the program.

Stipends, travel and dependency allowances will be provided from the National Science Foundation support. Application forms are obtainable from the Director, Institute of Biological Sciences and the Department of Science and Mathematics, School of Education, North Carolina State of the University of North Carolina at Raleigh. Forty participants are to be selected to receive the stipend awards.

INSTITUTE IN GENETICS FOR COLLEGE TEACHERS OF BIOLOGY AND GENETICS

June 14-July 23

The 1965 Summer Institute in Genetics for College Teachers of Biology and Genetics is to be conducted by the Department of Genetics and sponsored by the National Science Foundation. This is the fourth such Institute held here for college teachers and is designed to increase the competence of teachers of genetics in departments of biology throughout the country. This program is intended for college faculty of institutions that do not have active research programs in genetics and in which the teaching of this subject has to be provided by biologists needing additional training in this specialized area.

The program will offer coordinated course work, a series of lectures by international authorities and the opportunity to visit with scientists active in a wide range of research projects. The prseentation of topics will begin at an elementary level appropriate for mature students, but will go into greater depth than is usually the case with basic genetics courses. Four semester hours of graduate credit are allowed.

Stipends, travel and dependency allowances will be provided from the National Science Foundation support. Application forms are available from the Director, Institute of Biological Sciences and the Department of Genetics, North Carolina State of the University of North Carolina at Raleigh. Forty participants are to be selected to receive the stipend awards.

SUMMER INSTITUTE ON INTERACTIONS BETWEEN TOXICANTS AND PROTOPLASM

June 21-July 30

Each year fifteen southern institutions of higher learning cooperate with the Southern Regional Education Board to present summer sessions in specialized areas related to biology. The 1965 "Summer Institute on Interactions Between Toxicants and Protoplasm" is being

sponsored through SREB and supported by grants from the National Science Foundation and the National Institutes of Health.

This program will be focused on the biochemical aspects of the toxicants utilized in the fields of Entomology, Plant Pathology and Weed Science. The prime objectives of the Institute are: (1) to train highly qualified persons in each of the participating states for research and teaching leadership in this aspect of the field of pesticides on their respective campuses; (2) to accelerate the development of new knowledge concerning the basic interaction between toxicants with living systems; and (3) to transfer knowledge and skills from one discipline to another, thereby enhancing their utilization.

The six-weeks program of study will consist of lectures, discussions, laboratory exercises and a seminar series. A program involving recent advances in research and methodology in the broad field of the toxicology and mode of action of the various groups of pesticidal chemicals will be the main theme. Satisfactory completion of this course will constitute the equivalent of six semester hours of graduate credit.

The Institute will be administered through the Institute of Biological Sciences with Dr. F. E. Guthrie as Program Director. Stipends and travel allowances will be provided the forty students selected from qualified staff members and advanced graduate students. Inquiries should be directed to Dr. F. E. Guthrie, Program Director; Summer Institute in Pesticides; Department of Entomology; N. C. State of the University of North Carolina at Raleigh; Raleigh, North Carolina.

INSTITUTE FOR FOREIGN STUDENTS

A summer Sessions Foreign Student Institute will be conducted this summer beginning July 30 and ending August 27. The Institute will be open to foreign students who are interested in improving their facility in the use of English. The program will consist of a 4-week intensive program in English and Orientation (non-credit). Dr. George Poland, Head of the Modern Languages Department, will direct the program.

For further information please address inquiries to Dr. George Poland, Head of the Modern Languages Department, 303 Harrelson Hall, North Carolina State, Raleigh, N. C.

ACADEMIC YEAR INSTITUTE FOR HIGH SCHOOL TEACHERS OF BIOLOGY

The Institute of Biological Sciences will offer a program in which high school teachers are invited to undertake graduate study in any of the biological sciences. The program will begin in the first session of Summer School, June 14-July 23, at which time two new courses will be given: (1) Foundations of Modern Biology and (2)

Chemical Principles in Living Systems. The major portion of the Academic Year Institute is accomplished during the regular academic year.

The Academic Year Institute is sponsored by the National Science Foundation and is intended to provide a means by which high school teachers may acquire formal graduate-level experience. High school teachers interested in this program for the summer of 1965 and the acadmic year 1965-'66 should contact the Director of Academic Year Institute, Institute of Biological Sciences, North Carolina State of the University of North Carolina at Raleigh. Twenty participants are to be selected to receive the stipdend awards.

SCHOLARSHIP PROGRAM IN LIBERAL ARTS FOR NORTH CAROLINA PUBLIC SCHOOL TEACHERS

A scholarship program in liberal arts is to be sponsored by the Special In-Service Teacher Education Program of the State Department of Public Instruction and conducted by North Carolina State. Teachers may participate in this program in either session. Its purpose is to provide opportunities for a selected group of teachers to upgrade their knowledge and broaden their cultural backgrounds.

Certain courses in English, social studies, and the humanities, which are listed below, are being offered tuition free to teachers who are under contract to a local board of education in North Carolina for 1965-66. Participants will receive a refund for tuition for each semester hour completed in approved courses. The registration fee will also be refunded to applicants who complete three or more semester hours in approved courses.

Application forms and addition information can be obtained from the Director of the Summer Sessions. Applicants should indicate Certificate Field (elementary, secondary, administrative, etc.) and Class of Certificate (G, A, or below A) on applications. Each applicant should request the employing superintendent for 1965-66 to write to Dr. Jack Suberman, Director of Summer Sessions, recommending the applicant's participation and certifying that he is under contract for 1965-66.

EC 201
EC 202
EC 205
ENG 205
ENG 261
ENG 262
ENG 265
ENG 266
ENG 363
ENG 371
ENG 382
ENG 398
ENG 468
ENG 485

GN 301
HI 205
HI 245
HI 246
HI 251
HI 252
HI 261
HI 346
HI 404
MU 200
MU 210
MU 220
PS 201
PS 322
PS 485

PHI 201
PHI 205
PHI 405
REL 403
SOC 202
SOC 301
SOC 303
SOC 305
SOC 306
SOC 401
SS 301
SS 302
SS 491
SS 492

and selected courses in Biology, Mathematics, Modern Languages, and Physics only by permission of the Director and the pertinent department.

SUMMER SESSIONS SING

During both terms of the Summer Sessions, there will be a special Summer Session Sing under the direction of Mr. Bliss. This non-credit program will be held on Monday and Thursday nights, from 7 to 8:30 p.m., during each session. The Summer Session Singers will present programs during each of the semesters. Also Raleigh's Recreation Department will sponsor the Capital City Concert Band which will present concerts on and off the campus during the summer. This organization will rehearse each Wednesday from 7:30-9:30 p.m. in the Broughton High School band room. Mr. Richard Southwick is the conductor.

Course Listings

Summer Sessions–1965

1. Courses are listed by department, IBM symbol and numerical designator.
2. Semester hour credits for each course are given in parenthesis following the name of the course. An "X" after the semester hours indicates that the course carries no college credit.
3. Classes meet daily, Monday through Friday, except where specified to the contrary.
4. The symbols "LR" and "LB" before the clock hours refer to Lecture-Recitation and Laboratory hours, respectively. If there is no symbol before the clock hours, Lecture-Recitation is implied.
5. Courses numbered from 1 through 100 are preparatory courses carrying no college credit; courses in the 100, 200, 300 and 400 series are primarily designed for undergraduates; courses in the 500 series for graduates and advanced undergraduates; and courses in the 600 series for graduates only.

AGRICULTURAL ECONOMICS

AGC 699 Research in Agricultural Analysis (Arranged)
Prerequisite: Graduate Standing
First Session. Hours arranged. **Staff**

AGRICULTURAL ENGINEERING

AGE 411 Farm Power and Machinery (3) Prerequisite: AGE 211
First Session. LR 10:20-11:50 MTW LB 1:40-5:50 MW
Howell

AGE 590 Special Problems (Arranged) Prerequisite: Senior or graduate standing.
Both Sessions. Hours arranged. **Staff**

AGE 699 Research in Agricultural Engineering (Arranged)
Prerequisite: graduate standing in Agricultural Engineering
Both Sessions. Hours arranged. **Staff**

ANIMAL SCIENCE

ANS 590 Topical Problems in Animal Science (Arranged)
Both Sessions. Hours arranged. **Staff**

ANS 699 Research in Animal Science (Arranged)
Both Sessions. Hours arranged. **Staff**

BIOLOGICAL SCIENCES, INSTITUTE OF

BS 470 Foundations of Modern Biology (3) Prerequisites: Eighteen Semester Hours in Biological Sciences and Consent of Selection Committee. **Beal**
First Session. LR 8:00-9:30 MTTF; LB 1:00-4:00 W **Staff**

BS 471 Chemical Principles in Living Systems (3) Prerequisites: One year of Chemistry and Consent of Selection Committee.
First Session. LR 10:20-11:15 MTWTF **Reid**

BS 472 Foundations of Microbiology (3) Prerequisites: Eighteen Semester Hours in Biological Sciences and Consent of Selection Committee. Elkan
First Session. LR 10:20-11:15 MTTF; LB 2:00-4:00 MTh Staff

BS 601 Pesticide Toxicology (6) Prerequisites: Biochemistry and Advanced Course in Pesticides and Consent of Program Director.
First Session. LR 9:00-12:00 MTWTF Guthrie
LB 2:00- 5:00 MTWTh Staff
SEM 8:00-9:30 p.m. W Visiting Lecturer

BOTANY AND BACTERIOLOGY

BO 692 Special Problems in Bacteriology (Arranged)
Both Sessions. Hours arranged. Staff

BO 693 Special Problems in Botany (Arranged)
Both Sessions. Hours arranged. Staff

BO 699 Research (Arranged)
Both Sessions. Hours arranged. Staff

CHEMICAL ENGINEERING

CHE 205 Chemical Process Principles (4) Prerequisites: CH 103 or CH 107, MA 201
First Session. LR 8:00-9:30; LB Arranged

CHE 312 Unit Operations II (3) Prerequisite: CHE 311
First Session. LR 8:00-9:30 MWF; LB 8:00-10:10 TTh Marsland

CHE 497 Chemical Engineering Projects (2) Elective for seniors in Chemical Engineering.
Both Sessions. Hours arranged. Staff

CHE 597 Chemical Engineering Projects (1-3) Prerequisite or corequisite: CHE 312.
Both Sessions. Hours arranged. Staff

CHE 690 Readings in Chemical Engineering (Arranged)
Both Sessions. Hours arranged. Staff

CHE 699 Research (Arranged)
Both Sessions. Hours arranged. Staff

CHEMISTRY

CH 101 General Chemistry I (4)
Both Sessions. LR 7:30-9:00; LB 1:40-5:50 MW Staff
CH 101 and 103 are designed for students who do not plan to take the two-term sequences in organic chemistry (CH 221, 223) or physical chemistry (CH 431, 433).

CH 103 General Chemistry II (4) Prerequisite: CH 101
Both Sessions. LR 10:20-11:50; LB 1:40-5:50 TTh Staff

CH 105 Principles of Chemistry I (4)
First Session. LR 7:30-9:00; LB 1:40-5:50 MW Staff
CH 105 or 107 comprise a general inorganic chemistry course designed for students who intend to take advanced chemistry courses. Previous training in high school chemistry is desirable.

CH 107 Principles of Chemistry II (4) Prerequisite: CH 105
Both Sessions. LR 10:20-11:50; LB 1:40-5:50 TTh Staff

CH 215 Quantitative Analysis (4) Prerequisite: CH 103 or 107
First Session. LR 10:20-11:50; LB 1:40-5:50 TTh Staff

CH 220 Introductory Organic Chemistry (4) Prerequisite: CH 103 or 107.
LR 7:30-9:00; LB 1:40-5:50 TTh Staff

CH 221 Organic Chemistry I (4) Prerequisite: CH 107
First Session. LR 7:30-9:00; LB 1:40-5:50 MW Staff

CH 223 Organic Chemistry II (4) Prerequisite: CH 221
Second Session. LR 7:30-9:00; LB 1:40-5:50 MW Staff

CH 231 Introductory Physical Chemistry (4) Prerequisites: CH 103 or 107 and MA 102 or 112.
First Session. LR 10:20-11:50; LB 1:40-5:50 MW

CH 351 Introductory Biochemistry (3) Prerequisite: CH 220 or 223.
First Session. LR 9:10-10:10; LB 1:40-5:50 TTh Staff

CH 431 Physical Chemistry I (3) Prerequisites: CH 107, MA 202, and PY 206 or 208.
First Session. LR 7:30-9:00 Staff

CH 433 Physical Chemistry II (3) Prerequisite: CH 431
Second Session. LR 7:30-9:00 Staff

CH 490 Chemical Preparations (3) Prerequisite: CH 223
Both Sessions. Arranged. Staff

CH 499 Senior Research (credits arranged) Prerequisite: 3 yrs. Chemistry.
Both Sessions. Arranged. Staff

CH 699 Chemical Research (Arranged). Open only to graduate students in Chemistry.
Both Sessions. Hours Arranged. Staff

CIVIL ENGINEERING

CE 201 Engineering Measurements in Surveying (3)
First Session. LR 8:00-9:00; LB 1:30-5:00, TTh Staff

CE 324 Structural Analysis I (3) Prerequisites: EM 200; Corequisite: EM 301
First Session. LR 8:00-9:00; LB 1:30-5:00 MW Staff

CE 332 Structural Materials II (3)
First Session. LR 9:10-10:10; LB 1:30-5:00 TTh Staff

CE 382 Hydraulics (3) Prerequisite: EM 303
First Session. 10:20-11:50 Staff

CE 699 Civil Engineering Research (1-6)
Both Sessions. Hours Arranged. Staff

CROP SCIENCE

CS 542 Plant Breeding Field Procedures (2) Prerequisite: CS 541 or GN 541 or HS 541.
Conducted on an arranged basis during the entire summer, terminating approximately Sept. 15. Students should register for the course First Session noting it as a 12-week course. Staff

CS 591 Special Problems (Arranged) Prerequisite: Students admitted with consent of instructor.
Both Sessions. Hours Arranged. Staff

CS 699 Research (Arranged) Prerequisite: Graduate standing
Both Sessions. Hours Arranged. Staff

DESIGN

(These courses start First Session and run for nine weeks.)

DN 102 Design II (4) Required of first year students in the School of Design. 1:40-5:50 MTWTF.

DN 112 Descriptive Drawing II (2) Required of first year students in the School of Design. 1:40-4:50 MWF. Staff

DN 212 Descriptive Drawing IV (2) Prerequisite: DN 112. Required of second year students in the School of Design. 1:40-4:50 MWF. Staff

DN 312 Advanced Descriptive Drawing II (2) Prerequisite: DN 212. Required of third year students in the School of Design. 1:40-4:50 MWF. Staff

ECONOMICS

EC 201 Economics (3)
First Session. 8:00-9:30, 10:20-11:50
Second Session. 8:00-9:30 Staff

EC 202 Economics (3)
First Session. 10:20-11:50
Second Session 10:20-11:50 Staff

EC 205 The Economic Process (3)
First Session. 8:00-9:30
Second Session. 8:00-9:30 Staff

EC 301 Production Prices (3)
First Session. 10:20-11:50 Stober

EC 302 National Income and Economic Welfare (3)
Second Session. 10:20-11:50 Wilson

EC 310 Economics of the Firm (3)
First Session. 8:00-9:30 Harrell

EC 312 Accounting I (3)
First Session. 8:00-9:30, 10:20-11:50 Staff
Second Session. 8:00-9:30, 10:20-11:50 Staff

EC 313 Accounting II (3)
Second Session. 10:20-11:50

EC 407 Business Law I (3)
Second Session. 8:00-9:30 Hunt

EC 409 Introduction to Production Costs (3) Prerequisite: EC 312.
First Session. 10:20-11:50 Thompson

EC 420 Corporation Finance (3)
First Session. 8:00-9:30 Ufen

EC 425 Industrial Management (3) Prerequisite: Junior standing.
First Session. 8:00-9:30 Wood

EC 426 Personnel Management (3) Prerequisite: Junior standing
First Session. 10:20-11:50

EC 431 Labor Problems (3) Prerequisite: Junior standing
Second Session. 10:20-11:50 Bartley

EC 432 Industrial Relations (3) Prerequisite: Junior standing
Second Session. 8:00-9:30 Bartley

EC 490 Senior Seminar in Economics (3) Prerequisite: Consent of Instructor.
First Session. Hours arranged. El-Kammash

EC 491 Senior Seminar in Economics (3) Prerequisite: Consent of Instructor.
First Session. Hours arranged. Olsen

EC 502 Money, Income, and Employment (3) Prerequisite: EC 302 or EC 501 or equivalent.
First Session. 8:00-9:30 El-Kammash

EC 550 Mathematical Models in Economics (3) Prerequisite: EC 201 or EC 205, MA 202 or MA 212
First Session. 10:20-11:50 Harrell

EDUCATION

ED 100 Introduction to Industrial Education (2)
First Session. 8:00-9:30 MTWTh Oleson

ED 305 Analysis of Technical Education Programs and Course Construction (3).
First Session. 10:20-11:50 Oleson

ED 308 Visual Aids (2)
First Session. LR 12:30-2:00 MW; LB 2:00-4:00 MW or TTh
Rogers

ED 327 History and Philosophy of Industrial-Technical Education (3)
First Session. 10:20-11:50 Parker

ED 344 Secondary Education (3)
First Session. 10:20-11:50 Staff

ED 405 Industrial and Technical Education Shop and Laboratory Planning (3)
First Session. 12:00-1:30 Visiting Prof.

ED 410 Driver Education (3)
Both Sessions. 8:00-9:30; LB Arranged Crawford

ED 421 Principles and Practices in Industrial Cooperative Training (3)
First Session. 8:00-9:30 Visiting Prof.

ED 422 Methods of Teaching Industrial Subjects (4)
First Session. 1:40- 3:50 Smith
8:00-10:10 V. Prof.

ED 428 Organization of Related Study Materials (3)
First Session. 10:20-11:50 Smith

ED 440 Vocational Education (2)
First Session. 8:00-9:30 MTWTh Staff

ED 444 Student Teaching in Industrial Subjects (6)
First Session. Hours arranged. Mullen

ED 483 Instructional Aids and Devices (2)
First Session. To Be Arranged. Staff

ED 502 Analysis of Reading Abilities (3) Prerequisites: Six hours in Education or Psychology
First Session. 8:00-9:00 Rust

ED 503 Improvement of Reading Abilities (3) Prerequisites: Six hours in Education or Psychology
First Session. 10:20-11:50 Rust

ED 516 Community Occupational Surveys (2)
First Session. 8:00-9:30 MTWTh Hanson

ED 520 Personnel and Guidance Services (3) Prerequisites: Graduate standing and 6 hours of Education or Psychology
First Session. 8:009:30 Anderson

ED 524 Occupational Information (3) Prerequisites: Six hours of Education or Psychology, ED 420 or equivalent Visiting
Second Session. 8:00-9:30 Prof.

ED 525 Trade Analysis and Course Construction (3)
First Session. 10:20-11:50 Hanson
Second Session. Hours arranged.

ED 527 Philosophy of Industrial and Technical Education (3) Prerequisites: ED 422, ED 440. Visiting
First Session. 10:20-11:50 Prof.
Second Session. Hours arranged.

ED 529 Curriculum Materials Development (3)
Second Session. Hours arranged Visiting Prof.

ED 530 Group Guidance (3) Prerequisites: Six hours of Education or Psychology, ED 420 or equivalent.
First Session. 8:00-9:30 Morehead

ED 533 Organization and Administration of Guidance Services (3) Prerequisites: Graduate standing, ED 420 or equivalent.
First Session. 10:30-11:50 Morehead

ED 560 (IA 160) New Developments in I.A. Education (3)
First Session. 8:00-9:30 Hostetler

ED 563 Effective Teaching (3) Prerequisites: ED 411 or equivalent.
First Session. 10:20-11:50 Scarborough

ED 591 Special Problems in Industrial Education (Max. 6)
Both Sessions. Hours arranged. Hanson

ED 592 Special Problems in Mathematics Teaching (3)
First Session. Hours arranged. Speece

ED 593 Special Problems (3)
Both Sessions. Hours arranged. Staff

ED 594 Special Problems in Science Teaching (3) Speece
First Session. Hours ararnged. & Shannon

ED 595 (IA 595) Industrial Arts Workshop (mentally retarded) (3)
First Session. 10:20-11:30 Staff

ED 609 Planning and Organizing Technical Education Programs (3)
First Session. 8:00-9:30 Nerden

ED 610 Administration and Supervision of Vocational Education (3)
First Session. 10:20-11:50 Nerden

ED 615 Introduction to Educational Research (3)
Prerequisites: Twelve hours in Education
First Session. 8:00-9:30 Chansky

ED 630 Philosophy of Industrial Arts (2)
First Session. 10:20-11:20 Hostetler

ED 633 Techniques of Counseling (3) Prerequisites: Graduate Standing, ED 520.
First Session. 10:30-11:50 Anderson

ED 641 Laboratory and Practicum Experiences in Counseling (3)
Prerequisites: Advanced graduate standing. Permission to take course must be granted by Instructor by May 1, 1965.
First Session. Hours arranged. Anderson

ED 692 Seminar in Industrial Arts Education (1) Prerequisites: Graduate standing.
Both Sessions. Hours arranged. Staff

ED 699 Research (Credits by Arrangement) Prerequisites: Fifteen credits and permission of the advisor. Graduate
Both Sessions. Hours arranged. Staff

ENGINEERING GRAPHICS

E 101 Engineering Graphics I
First Session. 8:00-10:10
10:20-12:30
Second Session. 8:00-10:10 Staff

E 102 Engineering Graphics II
Both Sessions. 8:00- 9:30
10:20-11:50 Staff

ELECTRICAL ENGINEERING

EE 202 Elementary Circuits and Fields (2) Prerequisites: EE 201, MA 201. Required of sophomores in EE and MEA.
(Offered only in a 12-week sequence. The course counts for 2 semester hours in calculating loads for each session. Students should register for 2 semester hours at registration for each session, noting the 12-week sequence on their rosters.)
Both Sessions. LR 8:00- 9:00 MW Seagraves
8:00- 9:00 TT, or
9:10-10:20 MW, or
9:10-10:20 TT Seagraves
LB 1:40- 3:50 MW, or TTh, or MTh
Seagraves

EE 213 Elementary Circuits and Fields Lab (1)
First Session. LB 1:40-3:50 TTh Seagraves

EE 332 Principles of Electrical Engineering (4)
First Session. LR 7:30-9:00; LB 1:40-4:20 MW or TTh Staff

EE 438 Instrumentation in Nuclear Technology (3)
Second Session. 8:00-9:30 Staff

EE 699 Electrical Engineering Research (Arranged)
First Session. Hours Arranged. Staff
Thesis Preparation (Arranged)
Both Sessions. Hours Arranged. Staff

ENGINEERING MECHANICS

EM 200	Introduction to Mechanics (3) Corequisite: MA 301	
	Both Sessions. 8:00-9:30, 10:20-11:50	Staff
EM 211	Introduction to Applied Mechanics (3)	
	First Session. 10:20-11:50	Staff
EM 212	Mechanical Engineering Materials (3)	
	Second Session. 10:20-11:50	Staff
EM 301	Solid Mechanics I (3) Prerequisite: EM 200	
	Both Sessions. 8:00-9:30, 10:20-11:50	Staff
EM 303	Fluid Mechanics I (3) Prerequisite: EM 200	
	Both Sessions. 8:00-9:30, 10:20-11:50	Staff
EM 698	Special Topics in Mechanics (3)	
	Both Sessions. Hours Arranged.	Staff
EM 699	Research in Mechanics (Arranged)	
	Both Sessions. Hours Arranged.	Staff

ENGLISH

ENG 100	Refresher English (3x)	
	First Session. 8:00-9:30	Staff
	Both Sessions. 10:20-11:50	Staff
ENG 111	Composition and Rhetoric (3) Required of all freshmen	
	Both Sessions. 8:00-9:30, 10:20-11:50	Staff
ENG 112	Composition and Reading (3) Required of all freshmen	
	Both Sessions. 8:00-9:30, 10:20-11:50	Staff
ENG 205	Reading for Discovery (3)	
	Both Sessions. 8:00-9:30, 10:20-11:50	Staff
ENG 211	Business Communications (3) Prerequisite: ENG 112	
	First Session. 8:00-9:30	Staff
ENG 230	Fundamentals of Speech	
	Second Session. 8:00-9:30	Porter
ENG 231	Basic Speaking Skills (3)	
	First Session. 8:00- 9:30	Fountain
	10:20-11:50	Swain
	Second Session. 10:20-11:50	Porter
ENG 261	English Literature I (3)	
	First Session. 8:00-9:30	Toole
ENG 262	English Literature II (3)	
	Second Session. 8:00-9:30	Champion
ENG 265	American Literature I (3)	
	First Session. 10:20-11:50	Kesterson
ENG 266	American Literature II (3)	
	Second Session. 10:20-11:50	Martin
ENG 321	Scientific Writing (3) Prerequisite: Junior or Senior standing.	
	Second Session. 8:00-9:30	Staff
ENG 363	The Victorian Period (3)	
	Second Session. 8:00-9:30	Hawthorne
ENG 371	The Novel (3)	
	First Session. 10:20-11:50	Halperen
ENG 382	Short Prose Fiction (3)	
	First Session. 8:00-9:30	Wynne
ENG 398	Contemporary Literature (3)	
	First Session. 8:00-9:30	Knowles
ENG 468	Major American Writers (3)	
	First Session. 10:20-11:50	Staff
ENG 485	Shakespeare (3)	
	Second Session. 10:20-11:50	Champion

ENTOMOLOGY

ENT 590 Special Problems (Arranged) Prerequisites: Graduate standing and consent of instructor. Staff

ENT 699 Research in Entomology (Arranged) Prerequisite: Graduate standing in Entomology or closely allied fields.
Both Sessions. Hours arranged. Staff

EXPERIMENTAL STATISTICS

ST 361 Introduction to Statistics for Engineers I (3) Prerequisite: College Algebra
First Session. 7:30-9:00 Staff

ST 511-S Experimental Statistics II (3) Prerequisite: ST 311 or equivalent or graduate standing. Staff
First Session. 8:00-9:30

ST 512-S Experimental Statistics II (3) Prerequisite: ST 511-S or equivalent.
Second Session. 8:00-9:30 Staff

ST 691 Advanced Special Problems (1-3) Prerequisites: ST 502 or equivalent;
ST 522 and/or

ST 699 Research Arranged
Both Sessions. Hours arranged. Staff

FOOD SCIENCE

FS 590 Special Problems in Food Science (Arranged)
Both Sessions. Hours Arranged. Staff

FS 691 Special Research Problems in Food Science (Arranged)
Both Sessions. Hours Arranged. Staff

FS 699 Research in Food Science (Arranged)
Both Sessions. Hours Arranged. Staff

FORESTRY

FOR 204 Silviculture (3)
First Session. 8:00-5:00 Duffield, Maki
Second Session. 8:00-5:00 Perry, Grad. Asst.

FOR 205 Wood Machining Practicum (1)
First Session. 8:00-5:00 Gilmore

FOR 206 Wood Drying Practicum (1)
First Session. 8:00-5:00 Carter

FOR 207 Gluing Practicum (1)
First Session. 8:00-5:00 Rice

FOR 208 Wood Finishing Practicum (1)
First Session. 8:00-5:00 Carter

FOR 209 Plant Inspection (1)
First Session. 8:00-5:00 Carter

FOR 210 Mensuration Practicum (2)
Second Session. 8:00-5:00 Carter

FOR 211 Logging and Milling Practicum (2)
Second Session. 8:00-5:00 Carter

FOR 212 Graphic Methods (1)
Second Session. 8:00-5:00 Carter

FOR 264 Protection (3)
First Session. 8:00-5:00 Farrier Kelman, Bryant,
Second Session. 8:00-5:00 Bryant, and Grad. Asst.

FOR 274 Mapping and Mensuration (3)
First Session. 8:00-5:00 Bryant, Lammi, Grad. Asst.

FOR 284 Utilization (1)
Second Session. 8:00-5:00 Staff

FOR 591 Forestry Problems (1-5) Prerequisite: Senior or graduate standing.
Both Sessions. Hours Arranged. Staff

FOR 692 Advanced Forestry Management Problems (1-5) Prerequisite: Graduate standing.
Both Sessions. Hours Arranged. Staff

FOR 693 Advanced Wood Technology Problems (1-5) Prerequisite: Graduate standing.
Both Sessions. Hours arranged. Staff

FOR 699 Problems in Research (1-5)
Both Sessions. Hours Arranged. Staff

GENETICS

GN 501 Principles of Genetics (4) Prerequisite: Consent of Selection Committee.
First Session. LR 8:00-9:30, 10:15-12:00
LB 2:00-4:00, TTh or WF
Special lectures 7:30-9:30 p.m. MW Bostian

GN 695 Special Problems in Genetics (1-3) Prerequisites: Advanced graduate standing and consent of instructor.
First Session. Hours Arranged. Graduate Staff

GN 699 Research in Genetics (Arranged) Prerequisite: Graduate standing.
First Session. Hours Arranged. Graduate Staff

HISTORY

HI 205 Modern Western World (3)
First Session. 10:20-11:50 Barnhardt
Second Session. 10:20-11:50 To be announced

HI 245 History of European Civilization (3)
First Session. 8:00-9:30 Barnhardt

HI 246 History of European Civilization (3)
Second Session. 8:00-9:30 To be announced

HI 251 United States through Reconstruction (3)
First Session. 8:00-9:30 Kolb

HI 252 United States since Reconstruction (3)
Second Session. 8:00-9:30 Seegers

HI 261 United States in Western Civilization (3)
Second Session. 10:20-11:50 Seegers

HI 346 United States: The Middle Period, 1815-50 (3)
First Session. 10:20-11:50 Kolb

HI 404 Asia and the West (3)
First Session. 8:00-9:30 Beers

HORTICULTURAL SCIENCE

HS 301 Plant Propagation (3) Prerequisites: BO 103 or BS 100.
First Session. LR 8:00-9:00; LB 1:40-4:50 MW Staff

HS 342 Landscape Gardening (3)
First Session. LR 10:20-11:20; LB 1:40-4:50 TTh Staff

HS 599 Research Principles (Arranged) Prerequisite: Permission of instructor.
First Session. Hours Arranged. Staff

HS 699 Research (Arranged) Prerequisite: Graduate standing in Horticultural Science, consent of chairman.
First and Second Sessions. Hours Arranged. Staff

INDUSTRIAL ARTS

IA 102 Fundamentals of Materials and Processes (4)
First Session. 7:00-10:10 Moeller

IA 109 Wood Processing (4) Prerequisite: IA 102
Second Session. 10:20-1:30 Troxler

IA 205 Industrial Arts Design (3) Prerequisites: IA, 105, IA 109, IA 210
Second Session. 7:00-10:10 Troxler

IA 210 Metal Technology (4) Prerequisite: IA 102
First Session. 10:20-1:30 Moeller

IA 312 Electricity-Electronics (4) Prerequisites: PY 211, 212
Second Session. 7:00-10:10 Young

IA 560 (ED 560) New Developments in I. A. Education (3)
First Session. 8:00-9:30 Hostetler

IA 590 Laboratory Problems in Industrial Arts (Max. 6)
Both Sessions. Hours Arranged. Staff

IA 592 Special Problems in Industrial Arts (Max. 6)
Both Sessions. Hours Arranged. Staff

IA 595 (ED 595) Industrial Arts Workshop (Mentally Retarded) (3)
First Session. 10:20-11:50 Staff

IA 595 (ED 595) Industrial Arts Workshop (Electricity-Electronics) (3) Second Session. 8:00-12:00; 1:00-4:00
Second Session. 10:20-1:30 Young

ED 692 Seminar in Industrial Arts (1)
Both Sessions. Hours Arranged. Staff

ED 630 Philosophy of Industrial Arts Education (2)
First Session. 10:20-11:20 Hostetler

INDUSTRIAL ENGINEERING

IE 332 Motion and Time Study (4)
First Session. 10:20-1:20 Goldman
Will combine lecture and laboratory in a single session meeting daily.

IE 591 Project Work (Arranged)
First Session. Hours arranged. Anderson

IE 699 Industrial Engineering Research (Arranged)
First Session. Hours arranged. Anderson

MATHEMATICS

MA 2 Review Algebra (4x)
Both Sessions 8:00-10:10 Staff

MA 102 Analytic Geometry and Calculus I (4) Prerequisite: MA 111 or equivalent completed in high school
Both Sessions. 8:00-10:10, 10:20-12:30 Staff

MA 111 Algebra and Trigonometry (4)
Both Sessions. 8:00-10:10, 10:20-12:30 Staff

MA 112 Analytic Geometry and Calculus A (4) Prerequisite: MA 111 or equivalent completed in high school
Both Sessions. 10:20-12:30 Staff

MA 122 Mathematics of Finance (4) Prerequisite: MA 111
First Session. 8:00-10:10 Staff

MA 201 Analytic Geometry and Calculus II (4) Prerequisite: MA 102 (with a minimum grade of C for students in many curricula)
Both Sessions. 8:00-10:10, 10:20-12:30 Staff

MA 202 Analytic Geometry and Calculus III (4) Prerequisite: MA 201
Both Sessions. 8:00-10:10, 10:20-12:30 Staff

MA 211 Analytic Geometry and Calculus B (3) Prerequisite: MA 112
First Session. 10:20-11:50 Staff

MA 301 Elementary Differential Equations (3) Prerequisite: MA 202
Both Session. 8:00-9:30, 10:20-11:50 Staff

MA 401 Topics from Advanced Calculus I (3) Prerequisite: MA 301
Both Sessions. 10:20-11:50 Staff

MA 402 Topics from Advanced Calculus II (3) Prerequisite: MA 401
Second Session. 8:00-9:30 Staff

MA 403 Fundamental Concepts of Algebra (3) Prerequisite: MA 202 or MA 212
First Session. 10:20-11:50 Staff

MA 405 Introduction to Determinants and Matrices (3) Prerequisites: MA 202 or MA 212
Both Sessions. 8:00-9:30, 10:20-11:50 Staff

MA 421 Introduction to Probability (3) Prerequisite: MA 301 or consent of department
First Session. 12:00-1.30 Staff

MA 433 History of Mathematics (3) Prerequisite: MA 202 or MA 212
Second Session. 8:00-9:30 Staff

MA 511 Advanced Calculus I (3) Prerequisite: MA 301, and preferably a B average in all mathematics courses.
First Session. 8:00-9:30 Staff

MA 512 Advanced Calculus II (3) Prerequisite: MA 511
First Session. 10:20-11:50
Second Session. 8:00-9:30 Staff

MA 513 Introduction of Complex Variable Theory (3) Prerequisites: MA 402 or MA 512
First Session. 1:00-2:30 Staff

MA 514 Methods of Applied Mathematics (3) Prerequisite: MA 512
Second Session. 12:00-1:30 Staff

MA 527 Numerical Analysis I (3) Prerequisite: MA 402 or MA 511
Second Session. 10:20-11:50 Staff

*MA 532 Theory of Ordinary Differential Equations (3) Prerequisite: MA 511
8:00-9:30 Staff

*MA 541 Theory of Probability I (3) Prerequisite: MA 511
9:10-10:10 Staff

*MA 622 Vector Spaces and Matrices (3) Prerequisite MA 511
8:00-9:00 Staff

*MA 632 Operational Mathematics I Corerequisite MA 513 or MA 611
9:10-10:10 Staff

*MA 641 Calculus of Variations (3) Prerequisite: MA 512
10:20-11:20 Staff

*MA 651 Expansion of Functions (3) Prerequisites: MA 611, MA 633 or equivalents
1:00-2:00 Staff

MA 699 Thesis research. Arranged. Staff

* Courses starting in the first session offered 5 days a week for 8½ weeks for 3 hours total credit.

MECHANICAL ENGINEERING

ME 211 Introduction to Mechanical Engineering (3) Prerequisite: CH 103; Corequisite: MA 202, PY 208
First Session. 8:00-9:30, 10:20-11:50 Staff

ME 212 Mechanical Analysis (3) Prerequisite: ME 211; Corequisite: EM 200
Second Session. 8:00-9:30, 10:20-11:50 Staff

ME 301 Engineering Thermodynamics I (3) Prerequisites: MA 202, PY 208
First Session. 8:00-9:30, 10:20-11:50 Staff

ME 302 Engineering Thermodynamics II (3) Prerequisite: ME 301
Second Session. 8:00-9:30, 10:20-11:50

ME 303 Engineering Thermodynamics III (3) Prerequisite: ME 301
Second Session. 10:20-11:50 Staff

ME 305 Mechanical Engineering Lab I (1) Corequisite: ME 301
First Session. 1:40-5:50 MW Staff

ME 306 Mechanical Engineering Lab II (1) Prerequisites: ME 305, ME 212; Corequisite: EM 301
Second Session. 1:40-5:50 MW Staff

ME 307 Energy & Energy Transformation (3) Prerequisites: MA 201, PY 212
Second Session. 10:20-11:50 Staff

ME 315 Dynamics of Machines (3) Prerequisite: ME 212
First Session. 8:00-9:30 Staff

ME 352 Aerodynamics (3) Prerequisites: EM 200, MA 301
First Session. 8:00-9:30 Pinkerton

ME 353 Introduction to Aerothermodynamics (3) Prerequisites: ME 301, C or better in ME 352
Second Session. 8:00-9:30 Smetana

ME 402 Heat and Mass Transfer (3) Prerequisites: ME 302, MA 301
First Session. 8:00-9:30 Staff

ME 412 Mechanical Design II (3) Prerequisite: ME 401
First Session. 8:00-9:30 Rudisill

ME 431 Thermodynamics of Fluid Flow (3) Prerequisites: MA 301, ME 302 and EM 303 or ME 352
First Session. 10:20-11:50 Staff

ME 447 Performance, Stability, & Control of Flight Vehicles (3) Prerequisites: MA 401 or MA 441, C or better in ME 352
Second Session. 10:20-11:50 Smetana

ME 461 Aerospace Technology (3) Prerequisites: PY 208, EM 200, MA 301, ME 353
First Session. 10:20-11:50 Williams

ME 521 Aerothermodynamics (3) Prerequisites: ME 301, MA 301, ME 352 or EM 303
First Session. Hours aranged. Staff

ME 658 Molecular Gasdynamics (3) Prerequisites: ME 521, ME 602.
First Session. Hours arranged. Williams

ME 699 Mechanical Engineering Research
Both Sessions. Hours arranged. Staff

MINERAL INDUSTRIES

MIC 509 High Vacuum Technology (3) Prerequisites: CH 433 or ME 301
First Session. Arranged. Palmour

MIC 596 Advanced Ceramic Experiments (3)
First Session. Arranged. Staff

MIC 597 Advanced Ceramic Experiments (3)
Second Session. Arranged. Staff

MIC 635 Electronic Ceramics (3) Prerequisites: MA 441 and PY 407 or PY 414 or EE 531
Second Session. Arranged. Stadelmaier

MIC 699 Ceramic Research
Both Sessions. Arranged. Staff

MIM 201 Structure & Properties of Engineering Materials (3) Prerequisite: CH 103
Both Sessions: LR 12:00-1:00 Waller
LB 1:00-4:00 MWF Jordan

MODERN LANGUAGES

MLF 101 Elementary French (3)
First Session. 8:00-9:30, 10:20-11:50 Kitchin

MLF 102 French Grammar and Prose Reading (3) Prerequisite: MLF 101 or equivalent
First Session. 10:20-11:50 Kitchin
Second Session. 8:00-9:30, 10:20-11:50 Stack

MLF 201 French Prose (3) Prerequisites: MLF 101, MLF 102 or equivalent
First Session. 8:00-9:30 Staff

MLF 202 French Civilization (3) Prerequisites: MLF 101, MLF 102 or equivalent
Second Session. 10:20-11:50 Stack

MLF 401 French Grammar for Graduates (3)
First Session. 8:00-9:30 Ballenger

MLF 402 Scientific French (3) Prerequisite: MLF 401 or equivalent
First Session. To be announced. Allred
Second Session. To be announced. Poland

MLG 101 Elementary German
First Session. 8:00- 9:30 Titus & Allred
10:20-11:50 Titus

MLG 102 German Grammar and Prose Reading (3) Prerequisite: MLG 101 or equivalent
First Session. 8:00-9:30 Simonsen
Second Session. 8:00- 9:30 Ritter & Staff
10:20-11:50 Staff

MLG 201 German Prose (3) Prerequisite: MLG 102 or equivalent
First Session. 10:20-11:50 Simonsen

MLG 202 German Civilization (3) Prerequisite: MLG 102 or equivalent
Second Session. 10:20-11:50 Ritter

MLG 401 German Grammar for Graduates (3)
First Session. 8:00-9:30 Hall

MLG 402 Scientific German (3) Prerequisite MLG 401 or equivalent
First Session. 10:20-11:50 Hall & Staff
Second Session. To be announced Howard

MLS 101 Elementary Spanish (3)
First Session. 8:00-9:30 Staff

MLS 102 Spanish Grammar & Prose Reading (3) Prerequisite: MLS 101 or equivalent
First Session. 10:20-11:50 Staff
Second Session. 8:00-9:30 Shain

MLS 203 Review Grammar & Composition (3) Prerequisites: MLS 101, MLS 102, or equivalent
Second Session. 10:20-11:50 Shain

MLS 401 Spanish Grammar for Graduates (3)
First Session. 10:20-11:50 Ballenger

MLS 402 Scientific Spanish (3)
First Session. To be announced Staff
Second Session. To be announced Poland

MUSIC

MU 200 Music in Our Contemporary Life (3)
First Session: 8:00-9:30 Bliss
7:00-8:30 p.m. Staff
Second Session. 8:00-9:30 Adcock
7:00-8:30 p.m. Bliss

MU 210 A Survey of Music in America (3)
Second Session. 10:20-11:50 Adcock

MU 220 Musical Literature of the Romantic Period (3)
First Session. 10:20-11:50 Bliss

NUCLEAR ENGINEERING

NE 591	Special Topics in Nuclear Engineering (1-3) First Session. Hours arranged.	Staff
NE 691	Advanced Topics in Nuclear Engineering (1-3) First Session. Hours arranged.	Staff
NE 695	Seminar (1) First Session. Hours arranged.	Staff
NE 699	Research (Arranged) First Session. Hours arranged.	Staff

PHILOSOPHY AND RELIGION

PHI 201	Logic (3) First Session. 8:00-9:30, 10:20-11:50 Second Session. 8:00-9:30, 10:20-11:50	Kurylo Bradner
PHI 205	Problems and Types of Philosophy (3) First Session. 8:00-9:30, 10:20-11:50	Bredenberg
PHI 309	Marriage and Family Living (3) First Session. 8:00-9:30, 10:20-11:50 Second Session. 8:00-9:30, 10:20-11:50	Hicks Middleton
REL 403	Religions of the World (3) Second Session. 8:00-9:30, 10:20-11:50	Highfill
PHI 405	Foundations of Science (3) Second Session. 8:00-9:30, 10:20-11:50	Staff

PHYSICAL EDUCATION

The second and third digits for each course number in Physical Education indicates the activity being taken. The first digit indicates the class level of the student. (Freshman 1, Sophomore 2, Junior and Senior 3.)

Example: 141—A freshman taking angling.
241—A sophomore taking angling.
341—A junior or senior taking angling.

Angling—P.E. 141, 241, or 341 (1)	
First Session. 10:20-11:20	Smith
Second Session. 1:10-2:10	Keating
Intermediate Swimming—P.E. 121, 221, or 321 (1)	
First Session. 12:00-1:00, 1:10-2:10	Rhodes
Second Session. 12:00-1:00	Smaltz
Badminton—P.E. 142, 242, 342 (1)	
First Session. 9:10-10:10	Smith
Second Session. 12:00-1:00	Keating
Golf—P.E. 145, 245, or 345 (1)	
First Session. 8:00-9:00, 12:00-1:00 1:10-2:10	Clements & Edwards
Second Session. 8:00-9:00, 10:20-11:20, 1:10-2:10	Clements & Smaltz
Tennis—P.E. 149, 249, or 349 (1)	
First Session. 10:20-11:20, 2:20-3:20	Rhodes
Second Session. 9:10-10:10, 2:20-3:20	Keating & Smaltz
Softball—P.E. 165, 265, or 365 (1)	
First Session. 12:00-1:00	Smith
Second Session. 10:20-11:20	Keating
Volleyball—P.E. 169, 269, or 369 (1)	
First Session. 1:10-2:10	Smith
Second Session. 12:00-1:00	Clements

PHYSICS

PY 205 General Physics (4) Corequisite: MA 201 — Staff
Both Sessions. LR 8:00-9:30; LB 1:40-3:50 MW or TTh
First Session. LR 10:20-11:50

PY 206 General Physics (4) Corequisite: MA 201
First Session. LR 10:20-11:50
LB 1:40-3:50 MW or TTh — Staff

PY 207 General Physics (4) Corequisite: MA 201
Both Sessions. LR 8:00-9:30, 10:20-11:50
LB 1:40-3:50 MW or TTh — Staff

PY 208 General Physics (5)
Both Sessions. LR 8:00-10:10, 10:20-12:30
LB 1:40-3:50 MW or TTh — Staff

PY 211 General Physics (4) Prerequisite: MA 111
Both Sessions. LR 8:00-9:30, 10:20-11:50
LB 1:40-3:50 MW or TTh — Staff

PY 212 General Physics (4) Prerequisite: MA 111
Both Sessions. LR 8:00-9:30
LB 1:40-3:50 MW or TTh — Staff

PY 221 College Physics (5) Prerequisite: MA 111
Both Sessions. 7:30-10:10 — Staff

PY 407 Introduction to Modern Physics (3) Prerequisites: PY 202, MA 202
Both Sessions. 8:00-9:30 — Staff

PY 410 Nuclear Physics I (4) Prerequisite: PY 407
First Session. LR 10:20-11:50
LB 1:40-3:50 TTh — Waltner

PY 510 Nuclear Physics II (4) Prerequisite: PY 410
First Session. LR 7:30 9:00. LB arranged — Waltner

PY 695 Seminar (1)
Both Sessions. 1:00-2:30 MW — Staff

PY 699 Research (1-6)
Both Sessions. Hours arranged — Staff

PLANT PATHOLOGY

PP 615 Research in Plant Pathology (Arranged) Prerequisites: Graduate standing and consent of instructor
Both Sessions. Hours arranged — Staff

Thesis Preparation (Arranged)
Both Sessions. Hours arranged — Staff

POLITICS

PS 201 American Governmental System (3)
First Session. 8:00-9:30 — Bennett
Second Session. 8:00-9:30 — To be announced

PS 202 County and Municipal Government (3)
First Session. 10:20-11:50 — Bennett

PS 322 Contemporary World Politics (3)
First Session. 10:20-11:50 — Beers

PS 485 American Political Thought (3)
Second Session. 10:20-11:50 — To be announced

POULTRY SCIENCE

PO 201 Poultry Production (4) No prerequisite
A general introductory course in the principles & practices of poultry production
First Sessions. LR 10:20-11:50,
LB 1:40-4:20 TTh — Brown

PO 699 Poultry Research (1-6) Prerequisite: Graduate Standing
Both Sessions. Hours arranged — Staff

PO 698 Special Problems (1-6) Prerequisite: Graduate Standing
Both Sessions. Hours arranged — Staff

PSYCHOLOGY

PSY 200 Introduction to Psychology (3) — Bernard
Both Sessions: 8:00-9:30, 10:20-11:50 — Baldwin

PSY 302 Psychology of Personality & Adjustment (3) Prerequisite: PSY 200
First Session. 8:00-9:30 — Corter

PSY 304 Educational Psychology (3) Prerequisite: PSY 200
First Session. 10:20-11:50 — Johnson

PSY 337 Industrial Psychology I (3)
First Session. 8:00-9:30 — Drewes

PSY 476 Adolescent Psychology (2) Prerequisite: PSY 200
First Session. 12:00-1:00 — Barkley

PSY 535 Tests & Measurements (3) Prerequisite: six hours in Psychology
First Session. 8:00-9:30 — Johnson

PSY 550 Mental Hygiene in Teaching (3) Prerequisite: Six hours in Psychology
First Session. 10:20-11:50 — Barkley

PSY 570 Theories of Personality (3) Prerequisite: nine hours in Psychology
First Session. 10:20-11:50 — Corter

PSY 576 Developmental Psychology (3) Prerequisite: nine hours in Psychology including PSY 475 or 476
Second Session. Hours arranged — Staff

PSY 690 Seminar in Industrial Psychology (3)
Both Sessions. Hours arranged — Miller & Baldwin

PSY 693 Psychological Clinic Practicum (Max. 9) Prerequisite: eight hours in Psychology
Both Sessions. Hours arranged — Corter

PSY 699 Research in Psychology (3)
Both Sessions. Hours arranged — Staff

RECREATION AND PARK ADMINISTRATION

RPA 152 Introduction to Recreation (3)
First Sessions. 8:00-9:30 — Brantley or Hines
Second Session. 8:00-9:30 — Brantley

RPA 153 The Aquatic Program (2) Prerequisite: PE (swimming)
First Session. 8:00-9:00 — Stott

RPA 253 Principles of Physical Education (3)
First Session. 10:20-11:50 — Brantley or Hines
Second Session .10:20-11:50 — Hines

RPA 333 First Aid and Safety (2)
First Session. LR 10:20-11:50 MWF — Stott or Crawford
LB arranged
Second Sessions. LR 10:20-11:50 MWF — Crawford
LB arranged

RPA 353 Camp Organization & Leadership (3) Prerequisites: RPA 153 and RPA 201
First Session. LR 9:10-10:10 LB arranged — Stott

RPA 365 Methods & Materials in Health & Physical Education (3) Prerequisite: RPA 301
Second Session. 10:20-11:50 — Brantley

*RPA 470 Supervised Practice (6) Prerequisites: RPA 353, 355
First Session. MTWTFS Hours arranged — Hines & Miller

*RPA 472 Observation & Field Experience (2) Prerequisite: RPA 470
First Session. Hours arranged — Hines & Miller

* 9-weeks program

RURAL SOCIOLOGY

RS 699 Research (Arranged) Prerequisite: Permission of chairman of graduate study committee
Both Sessions. Hours arranged — Staff

SOCIAL STUDIES

SS 301 Science & Civilization (3) Prerequisites: for engineering students ENG 205, HI 205, EC 205; for others, permission of the department
Both Sessions. 8:00-9:30, 10:20-11:50 — Staff

SS 302 Science & Civilization (3) Prerequisites: Same as for SS 301
Both Sessions. 8:00-9:30, 10:20-11:50 — Staff

SS 491 Contemporary Issues (3) Prerequisites: for engineering students, SS 301, 302; for others, permission of the department
Both Sessions. 8:00-9:30, 10:20-11:50 — Staff

SS 492 Contemporary Issues (3) Prerequisites: for engineering students, SS 301, 302; for others, permission of the department
Both Sessions. 8:00-9:30, 10:20-11:50 — Staff

SOCIOLOGY AND ANTHROPOLOGY

SOC 202 Principles of Sociology (3)
First Session. 8:00-9:30, 10:20-11:50
12:00-1:30
Second Session. 8:00-9:30, 10:20-11:50 — Staff

SOC 301 Human Behavior (3)
First Session. 8:00-9:30, 10:20-11:50 — Lehman
Second Session. 8:00-9:30 — George

SOC 303 Current Social Problems (3)
First Session. 10:20-11:50 — Johnson
Second Session. 10:20-11:50 — Whiteside

SOC 305 Race Relations (3)
Second Session. 10:20-11:50 — Collins

SOC 306 Criminology (3)
First Session. 8:00-9:30 — Johnson

SOC 401 Human Relations in Industrial Society (3) Prerequisite: Senior standing or permission of the instructor
First Session. 10:20-11:50 — McCalister
Second Session. 8:00-9:30 — Collins

SOIL SCIENCE

SSC 560 North Carolina Soils and their Management (3) Prerequisites: SSC 200, SSC 302, or SSC 341, or equivalents.
First Session. (First three weeks.) 8:00-11:00 — Graduate Staff

SSC 590 Special Problems (Arranged) Prerequisites: SSC 200 and SSC 302
Both Sessions. Hours arranged — Graduate Staff

SSC 699 Research (Arranged)
Both Sessions. Hours arranged — Graduate Staff

TEXTILES

TX 221 Fundamentals of Textiles (4)
First Session. LR 7:30-9:00
LB 1:40-4:20 TTh — Moser

TX 261 Fabric Structure (4) Prerequisite: TX 221
First Session. LR 10:20-11:50
LB 1:40- 4:20 TTh — Berry

TX 281 Fiber Quality (4) Prerequisite: TX 221
First Session. LR 12:00- 1:30
LB 1:40- 4:20 MW Moser

TX 303 Fiber & Yarn Technology (4) Prerequisite: TX 281
First Session. LR 7:30-9:00
LB 1:40-4:20 TTh Pardue

TX 304 Fiber & Yarn Technology (4) Prerequisite: TX 303
Second Session. LR 10:20-11:50
LB 1:40-4:20 TTh Lassiter

TC 307 Textile Chemistry II (4) Prerequisite: TC 201
First Session. LR 12:00-1:30
LB 1:40-4:20 MW Hayes

TX 327 Textile Testing (4) Prerequisites: TX 303, TX 365, ST 361
First Session. LR 10:20-11:50
LB 1:40- 4:20 TTh Lassiter

TX 342 Knitting Principles (2) Prerequisites: TX 281 and TX 221
Second Session. 9:10-10:10 Middleton

TX 365 Fabric Technology (4) Prerequisites: TX 261, TX 281
First Session. LR 12:00-1:30
LB 1:40-4:20 MW Berry

TX 366 Fabric Technology (4) Prerequisite: TX 365
Second Session. LR 7:30-9:00
LB 1:40-4:20 MW Porter

TC 421 Fabric Finishing (2) Prerequisite: TC 201
First Session. 8:00-9:00 Hayes

TX 436 Staple Fiber Processing (3) Prerequisite: TX 303
First Session. LR 9:10-10:10
LB 1:40- 4:20 TTh Pardue

TX 442 Knitted Fabrics (3) Prerequisite: TX 342
Second Session. LR 7:30-8:30
LB 1:40-4:20 TTh Middleton

TX 483 Textile Cost Methods (3) Prerequisites: TX 303, TX 365
Second Session. LR 12:00-1:30 Lynch

TX 601 Yarn Manufacture (3 arranged) Prerequisite: Graduate Standing
First Session. Hours arranged Porter

TX 602 Yarn Manufacture (3 arranged) Prerequisite: Graduate Standing
Second Session. Hours arranged Porter

TX 621 Textile Testing III (2 arranged) Prerequisite: TX 522 or equivalent
First Session. Hours arranged Porter

TX 699 Textile Research for Textile Technology (Arranged)
Both Sessions. Hours arranged Porter

TC 699 Textile Research for Textile Chemistry (Arranged)
Both Sessions. Hours arranged Rutherford

ZOOLOGY

ZO 590 Special Studies (Arranged) Prerequisites: Approval of the instructor.
Both Sessions. Hours arranged. Staff

ZO 699 Research in Zoology (Arranged) Prerequisites: twelve semester credits in Zoology and approval of the instructor
Both Sessions. Hours arranged. Staff

North Carolina State

Home Study Courses

1965

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REGULATIONS GOVERNING CORRESPONDENCE COURSES

GENERAL INFORMATION

1. Any person who intends to take a correspondence course should fill out the registration form and mail it to the Division of General Extension.

2. A student will not be permitted to take more than two courses at one time, and it is recommended that one course be completed before another is begun.

3. Students may enroll at any time during the year.*

4. A course taken by correspondence must be completed within one year, unless a longer time is authorized by the Director of Extension.*

If a course is not completed within one year, the registration may be renewed for six months for a fee of $2. Credit is not allowed for any course completed in less than one month.

5. Students who desire credit must take a final examination upon the completion of all course assignments. The examination may be taken at North Carolina State, or under the supervision of the registrar of the nearest college or university. The examination must be passed if credit is allowed.

6. A student may not take for credit by correspondence a subject for which either degree or certificate credit has been given previously by any institution.

7. Students must provide themselves with prescribed textbooks. Such books may be purchased directly from publishers or from the Student Supply Store, N. C. State, Raleigh, N. C. Do not send money for text books to the Division of General Extension.

8. The quality of a student's work is indicated by grades as follows:

A (90 or above)
B (80 to 98)
C (70 to 79)
D (60 to 69)
F (Below 60, failure)

(A student must make 60 on the final examination to pass the course.)

9. Before credit is granted for any course, all graded assignments must be returned to the Division of General Extension.

10. As soon as you have secured lesson material and the required text, begin work on assignment one. Study the assignment carefully before attempting to put into final form the written work to be submitted. Attach a cover sheet to your completed lesson and mail to the Division of General Extension, North Carolina State, Box 5125, Raleigh. Then begin work on assignment two. Assignment one will be graded by your instructor and returned to you promptly. In this way corrected assignments will help you with future assignments.

11. In some courses specifications for written work will be prescribed by the instructor. For most courses lessons should be written on 8½ x 11 plain white paper, with typewriter or pen. Neatness and legibility are essential always. All work submitted for correction should be exclusively your own.

DEGREE CREDIT AT NORTH CAROLINA STATE

Students desiring degree credit for correspondence courses at North Carolina State must abide by certain college rules concerning grades, credits, prerequisites, final examinations, etc. See rules concerning degree credits on page 67. These rules apply to students who have been in residence and are working for a degree at North Carolina State.

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*N. C. State students see "Degree Credit at North Carolina State"

TEACHER CERTIFICATE CREDIT

Questions concerning requirements for teaching certificates should be addressed to the Director of Certification, State Department of Public Instruction, Raleigh, N. C.

FEES AND REFUNDS

For residents of North Carolina:
$10.00 for a course of one semester hour
$20.00 for a course of two semester hours
$30.00 for a course of three semester hours

For non-residents of North Carolina:
$12.00 for a course of one semester hour
$24.00 for a course of two semester hours
$36.00 for a course of three semester hours

No tuition fees can be refunded after a course is begun. In the event that no work has been done during the first three months, and application is made within that time, two-thirds of the tuition fee for a course will be refunded.

P. L. 550

A veteran planning to enroll under P.L. 550 should get a certificate of eligibility from his Veterans Administration regional office. He then enrolls, pays his tuition and buys his books. Each quarter he makes a report of his progress to his regional office, and the Veterans Administration refunds part of his expenditure, prorated according to the amount of work which he has completed during that three months' period.

FACULTY OF CORRESPONDENCE INSTRUCTION

FRED J. ALLRED, M.A., *Associate Professor of Modern Languages*

LUTHER WESLEY BARNHARDT, M.A., *Associate Professor of History and Political Science*

VESTER R. BRANTLEY, M.A., *Assistant Professor of Mathematics*

HENRY S. BROWN, Ph.D., *Associate Professor of Geological Engineering*

TALMADGE THURMAN BROWN, M.S., *Associate Professor of Poultry Science*

HENRY CHARLES COOKE, M.S., *Associate Professor of Mathematics*

W. CURTIS FITZGERALD, JR., *Assistant Professor of Philosophy & Religion*

ARNOLD H. GRANDAGE, *Professor of Experimental Statistics*

MRS. RUTH BADGER HALL, M.A., *Assistant Professor of Modern Languages*

GEORGE B. HOADLEY, D.Sc., *Head of Department and Professor of Electrical Engineering*

ABRAHAM HOLTZMAN, Ph.D., *Professor of History and Political Science*

WILLIAM C. HOOD, *Assistant Professor of Mineral Industries*

ELMER H. JOHNSON, Ph.D., *Professor of Sociology*

JOSEPH CLYDE JOHNSON, M.A., *Associate Professor of Psychology*

GEORGE D. JONES, *Professor, In Charge Entomology Extension*

HENDERSON G. KINCHELOE, Ph.D., *Professor of English*

CHARLES FREDERICK KOLB, M.A., *Assistant Professor of History and Political Science*

CHARLES F. LEWIS, M.A., *Assistant Professor of Mathematics*

ARMSTRONG MALTBIE, B.A., *Assistant Professor of Mathematics*

SELZ C. MAYO, Ph.D., *Head of Department and Professor of Rural Sociology*

JOSEPH LEONARD MIDDLETON, B.D., *Associate Professor of Philosophy and Religion*

OLIVER H. ORR, JR., Ph.D., *Assistant Professor in History*

HOWARD A. PETREA, M.A., *Associate Professor of Mathematics*

GEORGE W. POLAND, Ph.D., *Head of Department and Professor of Modern Languages*

GLENN ORVICE RANDALL, M.S., *Professor of Horticulture*

CHARLES H. ROGERS, *Assistant Professor of Education*

ROBERT SCHMIDT, B.Sc., *Associate Professor Emeritus of Horticulture*

ALFRED BERNARD ROWLAND SHELLEY, M.A., *Associate Professor of English*

CLARENCE B. SHULENBERGER, M.A., *Professor of Economics*

EDWARD HOYLE STINSON, *Instructor in Engineering Graphics*

OLIVER GEORGE THOMPSON, M.A., *Assistant Professor of Economics*

THOMAS LESLIE WILSON, M.A., *Professor Emeritus of English*

SANFORD RICHARD WINSTON, Ph.D., *Professor of Sociology*

SHOU-LING WANG, *Associate Professor of Engineering Mechanics*

LAWRENCE M. WODEHOUSE, *Assistant Professor of Architecture*

THOMAS W. WOOD, Ph.D., *Professor of Economics*

COURSES OF INSTRUCTION

Tuition fees listed with the descriptions of courses apply to residents of North Carolina. FOR NON-RESIDENT FEES SEE "FEES AND REFUNDS."

AGRICULTURE

The following courses in Agriculture can be taken either as university credit courses or practical courses. Should college credit be desired, an examination will be given at the end of each course. As practical courses, no examination will be required, and a certificate will be issued upon completion.

Hort. Ex. 220—Vegetable Gardening. Mr. Schmidt.
Tuition fee, $20.00 2 Semester Hours.
Prerequisites: None. For university credit, university standing required.
Importance of vegetables. Soils and soil preparation, seedage, plant productions, fertilization, irrigation, cultivation and weed control, pest control, and grazing culture of specific vegetable crops.

Hort. Ex. 223—Flower Growing. Mr. Randall.
Tuition fee, $20.00 2 Semester Hours.
Prerequisites: None. For university credit, university standing required.
Principles, methods and practices in flower growing.

Hort. 301—Plant Propagation. Mr. Randall.
Tuition fee, $30.00 3 Semester Hours.
A study of principles, methods and practices in seedage, cuttage, division, budding, grafting and other methods of plant propagation.

Poul. Ex. 200—Poultry Production Mr. Brown
Tuition fee, $20.00 2 Semester Hours.
Prerequisites: None. For university credit, university standing required.
Fundamental principles of broiler, market egg, hatching egg and turkey production. Identification of chicken and turkey classes, breeds and varieties. Breeding, incubation, raising, housing, feeding, disease and parasite control. Marketing of chickens, eggs and turkeys.

ARCHITECTURE

Arch. 321—History of Architecture, I Mr. Wodehouse.
Tuition fee, $30.00 3 Semester Hours.
Prehistoric; The Five Great Building Cultures; The Early Architecture of the Western World; The Pre-Columbian Architecture of America; Ancient Classic Architecture; The Architecture of Islam.

ECONOMICS

Ec. 201—Economics. Mr. Shulenberger.
Tuition fee, $30.00 3 Semester Hours.
This is the first semester of the course in principles of economics. The major materials covered include: Introduction to economics; the resources, income and production organization of the United States; money, banking, and the volume of economic activity; prices and allocation of resources.

Ec. 202—Economics. Mr. Thompson.
Tuition fee, $30.00 3 Semester Hours
This is the second semester of the course in principles of economics. The major materials covered include: Distribution of income; international economics; public finance; public policy and economic growth.

Ec. 407—Business Law. Mr. Thompson.
Tuition fee, $30.00 3 Semester Hours.
A course dealing with elementary legal concepts, contracts, agency,

empployment, negotiable instruments, personal property, bailments, transportation, sales and personal property.

Ec. 425—Industrial Management. Mr. Wood.
Tuition fee, $30.00 3 Semester Hours.
An introduction to the organizational, production and supervision prob lems of modern management. Includes basic principles and techniques for the solution of industrial problems in internal organization and production control.

Ec. 426—Personnel Management. Mr. Wood.
Tuition fee, $30.00 3 Semester Hours.
The scientific management of manpower, from the viewpoint of the supervisor and the personnel specialists. A study of personnel policy and a review of the scientific techniques regarding the specific problems of employment, training, promotion, transfer, health and safety, employee service, and joint relations.

EDUCATION

Ed. 344—Secondary Education. Mr. Rogers.
Tuition fee, $20.00 3 Semester Hours.
An overview of secondary education, including development, problems, services, trends, teaching profession, role of school in the community, purposes, and objectives. The development and status of secondary education in North Carolina.

ENGINEERING

M.E. 101—Engineering Graphics I. Mr. Stinson.
Tuition fee, $20.00 2 Semester Hours.
Lettering; instrument practice; geometrical construction; projections; technical sketching, sections; auxiliary projections; revolution pictorial drawing; fasteners; intersection and development; working drawings; charts and graphs; tracing and blueprinting, and other reproductions. Geometrical magnitudes represented by points, lines, planes and solids.

M.E. 102—Engineering Graphics II. Mr. Stinson.
Tuition fee, $10.00 1 Semester Hour.
A continuation of M.E. 101.

EM 200—Introduction to Mechanics Staff
Tuition fee, $30.00 3 Semester Hours.
An introduction to the principles and concepts which form the basis for studies in dynamics, solid mechanics, and fluid mechanics. The nature and properties of force systems and stress fields. The motion of particles and description of deformation of continuous media. The role of Newton's laws, the concepts of continuity and equilibrium, and the conservational principles in problems in mechanics.

EE 211—Elementary Circuits and Felds Theory. Mr. Hoadley.
Tuition fee, $30.00 3 Semester Hours.
Prerequisite: Evidence of completion of a course in Calculus must be submitted, preferably by transcript.
This is the classroom part of EE 201. The laboratory part is listed as EE 213 in the summer school catalog. The course covers basic concepts in electrical engineering, Kirchhoff's laws, power, energy, simplification of electrical networks, conductors, resistors, conduction in solids and liquids, and elementary transients in electric circuits.

ENGLISH

***Eng. 111—Composition.** Mr. Shelley.
Tuition fee, $30.00 3 Semester Hours.
Grammar review and intensive practice in composition; reading and analysis of literary types, with emphasis upon both composition and appreciation; direct supplementary, collateral reading.

***Eng. 112—Composition.** Mr. Shelley.
Tuition fee, $30.00 3 Semester Hours.
A continuation of Eng. 111.

Eng. 211—Business Communications. Mr. Wilson.
Tuition fee, $30.00 3 Semester Hours.
Review of principles applicable to business writing; types of letters; form, style, and tone of effective correspondence.

Eng. 261—Background of English Civilization I. Mr. Shelley.
Tuition fee, $30.00 3 Semester Hours.
A reading course in English literature from the Anglo Saxon invasions to the Romantic period, with an emphasis on the contributions of English life and thought to Western Civilization.

Eng. 262—Background of English Civilization II. Mr. Shelley.
Tuition fee, $30.00 3 Semester Hours.
English literature from the Romantic period to the present day. This course may be taken either as a continuation of Eng. 361 or as an independent course.

Eng. 265—The American Mind I. Mr. Kincheloe.
Tuition fee, $30.00 3 Semester Hours.
Masterpieces and outstanding types of American literature in their historical settings, from the Early Colonial Period to 1840.

Eng. 266—The American Mind II. Mr. Kincheloe.
Tuition fee, $30.00 3 Semester Hours.
Masterpieces and outstanding types of American literature in their historical settings, 1840-1890.

Eng. 100—English Refresher. Mr. Shelley.
Tuition fee, $30.00 No credit.
The purpose of this course is to review the basic elements of grammar and composition. It is especially designed to assist those with weak English grades in high school, or for students desiring to satisfy the university entrance requirements for English.

ENTOMOLOGY

Ent. No. 322—Beekeeping. Staff
Tuition fee, $30.00 3 Semester Hours.
Sixteen lessons (with 16 laboratory exercises, if for credit) supplemented by texts, circulars, etc. A study of bees and beekeping:—History, how to get started, life within the colony, seasonal management, honey and beeswax, diseases, nectar resources, production of comb and extracted honey, pollination, requeening, queen rearing, and marketing.

GEOLOGY

Mig. 101—Earth Science. Mr. Hood.
Tuition fee, $30.00 3 Semester Hours.
Introductory course in General Geology; changes in the earth, and underlying physical and life processes.

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* No student who has not previously been admitted to a college may be allowed to receive college credit on more than one semester of Eng. 111 and 112 at N. C. State.

Mig. 208—Physical Geography. Mr. Brown.
Tuition fee, $30.00 3 Semester Hours.
The principles of Physical Geography with special reference to the physiographic provinces of the United States. Special study will be made of the physical geography of North Carolina and its relation to human activities.

HISTORY

Hist. 225—Modern Europe. Mr. Barnhardt.
Tuition fee, $30.00 3 Semester Hours.
A study of the political, economic, intellectual, and social developments in Europe from the age of Columbus to 1815.

Hist. 226—Modern Europe. Mr. Barnhardt.
Tuition fee, $30.00 3 Semester Hours.
A study of the political, economic, intellectual, and social developments in Europe from 1815 to the present.

Hist. 251—The United States to 1865. Mr. Kolb.
Tuition fee, $30.00 3 Semester Hours.
A study of major historical developments in the growth of the American nation through the Civil War.

Hist. 252—The United States since 1865. Mr. Kolb.
Tuition fee, $30.00 3 Semester Hours.
A study of major historical developments in the growth of the American nation since the Civil War.

Hist. 306—North Carolina History. Mr. Barnhardt.
Tuition fee, $20.00 2 Semester Hours.
The political, social, and economic developments of North Carolina from colonial beginnings to the present.

Hist. 412—Recent United States History. Mr. Orr.
Tuition fee, $30.00 3 Semester Hours.
A study of the main currents in American political, economic, social and diplomatic history in the twentieth century.

POLITICS

Pol. Sc. 201—The American Governmental System. Mr. Holtzman.
Tuition fee, $30.00 3 Semester Hours.
A study of the American federal system, integrating national and state government, with emphasis on constitutional principles, major governmental organs, governmental functions, and the politics and machinery of elections. Some attention is given to other types of political systems, and comparisons are made where relevant through the course.

MATHEMATICS

Math. 111—Algebra and Trigonometry Mr. Brantley.
Tuition fee, $40.00 4 Semester Hours.
Rectangular coordinates, functions and graphs, linear equations and determinants, quadratic equations, inequalities, systems of equations involving quadratics, proportion and variation, binominal theorem, progressions, logarithms, exponential and logarithmic curves, trigonometric functions of general angle, derivation of trigonometric identities and formulas, the solution of plane triangles, with practical applications, slide rule.

Math. 102—Analytic Geometry and Calculus I Mr. Lewis.
Tuition fee, $40.00 4 Semester Hours.
Radian measurement of angles, trigonometric curves, inverse trigonometric functions, trigonometric equations, complex numbers, theory of

equations, loci of equations, the straight line, circle, parabola, ellipse, hyperbola, the general equations of second degree, curve sketching, polar coordinates, parametric equations, curve fitting, coordinates in space, planes, lines and surfaces.

MA 107—Plane Trigonometry. Mr. Petrea.
Tuition fee, $30.00 3 Semester Hours.

This course includes a review of logarithms, also angles, arc angles, arc length, trigonometric functions of an angle, reduction formulas, inverse, trigonometric functions, equalities, graphs, solution of triangles (mainly slide rule solutions), and complex numbers.

Math. 112—Analytic Geometry and Calculus A. Mr. Brantley.
Tuition fee, $40.00 4 Semester Hours.

A unified course, beginning with elementary ideas in analytic geometry and calculus, with the introduction of additional work in trigonometry where needed; rectangular and polar coordinate systems, the fundamental locus problem, lines and conic sections, curve tracing, the derivtative, with applications to geometry and simple practical problems.

Math. 122—Mathematics of Finance and Elementary Statistics.
Tuition fee, $40.00 Mr. Lewis
Prerequisite: Math. 111 4 Semester Hours.

Simple and compound interest, annuities and their application to amortization and sinking fund problems, installment buying, calculation of premiums of life annuities and life insurance, elementary statistics.

Math. 211—Analytic Geometry and Calculus B. Mr. Brantley
Tuition fee, $30.00 3 Semester Hours.

An integrated course in the fundamentals of calculus, including formal differentiation and integration. Basic applications to geometry, rates, maxima and minima, areas, volumes, first and second moments, and centroids included. Additional topics from analytic geometry, not covered in Math. 112, are introduced as needed as a basis for calculus.

Math. 212—Analytic Geometry and Calculus C. Mr. Brantley
Tuition fee, $30.00 3 Semester Hours.
A continuation of Math. 211.

Ma. 201—Analytic Geometry and Calculus II. Mr. Brantley.
Tuition fee, $40.00 4 Semester Hours.
Prerequisite: Ma. 102.

Required of sophomores in the School of Engineering. The second of three semesters of a unified course in Analytic Geometry and Calculus. Topics studied include indefinite and definite integrals of algebraic functions and their applications; differentiation of transcendental functions; polar coordinates, parametric equations, currilinear motion and curvature; formal integration; integration by parts, substitution and partial fractions.

Ma. 201—Analytic Geometry and Calculus III. Mr. Brantley
Tuition fee, $40.00 4 Semester Hours.
Prerequisite: Ma. 201.

Required of sophomores in the School of Engineering. The third of three semesters of a unified course in Analytic Geometry and Calculus. Topics studied include areas, volumes, lengths of curves, centroids, moments of inertia in rectangular and polar coordinates; approximate integration, improper integrals, indeterminate forms; infinite series and expansion of functions; solid analytic geometry and partial differentiation, multiple integrals in rectangular, cylindrical and spherical coordinates.

Review of Elementary Algebra. Mr. Maltbie.
Tuition fee, $40.00 No Credit.

This course gives a thorough review of algebra with emphasis on quadratic equations, fractions and fractional equations, verbal problems, radicals, exponents, and algebraic manipulation.

Plane Geometry. Mr. Petrea.
Tuition fee, $40.00 No College Credit.
A course which includes the traditional values of plane geometry including development in reasoning logically to yield legitimate proofs. It covers the theory and application of lines, angles, triangles, circles, parallelograms, trapezoids, and other related plane figures. This course will be accepted by N. C. State for the entrance requirement in plane geometry.

Solid Geometry. Mr. Cooke.
Tuition fee, $20.00 No College Credit.
This course is offered for students desiring to satisfy the college entrance requirements for solid geometry. It includes: (1) emphasis on spatial perception and the ability to recognize and to work with composite solids; (2) further development (beyond that in plane geometry) in reasoning logically to give legitimate proofs; and (3) mensuration formulas for both the elementary and composite solids.

MODERN LANGUAGES

M.L.F. 101—Elementary French. Mr. Allred.
Tuition fee, $30.00 3 Semester Hours.
Elements of grammar are analyzed with readings and translations. Practice in understanding French is given by repeated use of simple forms. This course is intended for students who have little or no previous knowledge of French.

M.L.F. 102—French Grammar and Prose Reading. Mr. Allred.
Tuition fee, $30.00 3 Semester Hours.
Continuation of M. L. 101. Study of French Grammar completed, and additional emphasis placed on reading and translation.

M.L.S. 101—Elementary Spanish. Mr. Poland.
Tuition fee, $30.00 3 Semester Hours.
Elements of grammar are analyzed with readings and translations. Practice in understanding Spanish is given by repeated use of simple forms. This course is intended for students who have little or no previous knowledge of Spanish.

M.L.S. 102—Spanish Grammar and Prose Reading. Mr. Poland.
Tuition fee, $30.00 3 Semester Hours.
Grammar analysis with stress on irregular verbs. Practice in reading and translation is continued.

M.L.G. 101—Elementary German. Mrs. Hall.
Tuition fee, $30.00 3 Semester Hours.
A comprehensive study of the German language from the viewpoint of structure and technique. It is supplemented by a series of easy readings and translations including simple exercises. No previous training in the language is necessary.

M.L.G. 102—German Grammar and Prose Reading. Mrs. Hall.
Tuition fee, $30.00 3 Semester Hours.
A continuation of M.L. 103.

PHILOSOPHY

PHI 205—Problems and Types of Philosophy Mr. Fitzgerald.
Tuition fee, $30.00 3 Semester Hours.
An introduction to selected areas of philosophy: logic, theories of knowledge, political philosophy, ethics, philosophy of religion. Emphasis upon main contemporary treatment of these areas.

PHI 309—Marriage and Family Living Mr. Middleton.
Tuition fee, $30.00 3 Semester Hours.
Secular and religious concepts of marriage; economic, physiological and socio-psychological aspects of premarital and marital relationships; parenthood; analysis of principles in terms of which value judgments relative to marriage and family living may be made with maximum rationality; formulation of philosophy of marriage.

PSYCHOLOGY

Psy. 200—Introduction to Psychology. Staff.
Tuition fee, $30.00 3 Semester Hours.
A study of the general characteristics and development of human behavior, emphasizing the problems of motivation, emotion, learning, and thinking.

Psy. 302—Psychology of Personality and Adjustment. Staff.
Tuition fee, $30.00 3 Semester Hours.
A study of factors involved in the development of the normal personality, emphasizing the principal factors controlling human behavior and their relationship to adjustment mechanisms.

Psy. 304—Educational Psychology. Mr. Johnson.
Tuition fee, $30.00 3 Semester Hours.
Applications of psychology to education; problems of learning, motivation, interests; the measurement of educational efficiency; mental hygiene.

Psy. 476—Psychology of Adolescence. Staff
Tuition fee, $20.00 2 Semester Hours.
Mental growth, social development, and interests of adolescent boys and girls.

RURAL SOCIOLOGY

Rur. Soc. 301—Sociology of Rural Life. Mr. Mayo.
Tuition fee, $30.00 3 Semester Hours.
Prerequisites: Completion of Freshman year.
A systematic socioligical analysis of the characteristics, institutions and problems of rural life. Part I is a brief description of the basic concepts, the theoretical framework and the method of analysis if institutions and problems. Part II consists of systematic sociological analysis of the major social institutions and their respective problems. Part II portrays the role of the community as an area of institutional functioning and societal integration.

SOCIOLOGY

Soc. 202—General Sociology (Man and Society). Mr. Winston.
Tuition fee, $30.00 3 Semester Hours.
Basic principles of sociology, general social organization, and human behavior.

Soc. 301—Human Behavior. Mr. Winston.
Tuition fee, $30.00 3 Semester Hours.
A study of the effects of social interaction upon individual behavior and personality; collective attitudes and behavior as products of group experience; analysis of fashions and fads, crowds, mobs, publics, social movements.

Soc. 303—Current Social Problems. Mr. Johnson.
Tuition fee, $30.00 3 Semester Hours.
Study of the social and cultural aspects of specific problems such as crime, divorce, race conflict, illness, poverty, housing, recreation and personality adjustment to demonstrate the basic integration of society and community life.

Soc. 304—Contemporary Family Life. Mr. Winston.
Tuition fee, $30.00 3 Semester Hours.
Basic interactions involved in courtship, marriage, and family life; analysis of the influence of family life upon economic, social, political, and religious activities; cultural and technological changes affecting the family; analysis of family structure and functions.

..Soc. 306—Criminology. Mr. Winston.
Tuition fee, $30.00 3 Semester Hours.
This course will take up the causes and conditions leading to crime, and study the methods of handling criminals. It will discuss the influence of various factors in producing criminal behavior.

Soc. 402—Urban Sociology. Mr. Winston.
Tuition fee, $30.00 3 Semester Hours.
Problems arising from growth of modern town and city life; city planning in regard to social and industrial progress.

STATISTICS

Statistics 361—Introduction to Statistics for Engineers. Mr. Grandage.
Tuition fee, $30.00 3 Semester Hours.
Prerequisites: None. For university credit, university standing required.
Introduction to industrial sampling and inspection. Use of statistical methods in interpreting tolerances and specifications, and in controlling quality during production. Elements of theory of significance testing, reliability of industrial and scientific measurements.

REGULATIONS GOVERNING CORRESPONDANCE COURSES FOR DEGREE CREDIT AT NORTH CAROLINA STATE EFFECTIVE SEPTEMBER 1, 1958

1. No student will be permitted to register for any course without approval of the Dean or Director of Instruction of the School in which he is registered.

2. No correspondence course may be completed in less than one month or more than one year from the date of registration.

3. Students planning to enroll in the fall semester must complete their correspondence courses by *September 1;* by *January 1* if they are to enroll in spring semester; or at least two weeks prior to registration day if they are to enroll in summer school.

4. Students should send in individual assignments as they are completed. An instructor may refuse credit to a student who sends in all assignments within a brief period of time.

5. A grade of "F" will be reported on any course not completed within the specified time unless the course is officially dropped by written notice to the General Extension Division within 90 days after the date of registration. After the 90 day period a course can be dropped without a grade of "F" only with the permission of the Dean or Director of Instruction.

6. All examinations in correspondence courses taken for university credit will be given on the campus or at another designated institution, with the approval of the department giving the course.

7. Regardless of the grades earned on the written assignments, a student must make a passing grade of at least 60 on the final examination in order to receive credit for the course.

8. No student may register for more than two correspondence courses at one time.

9. Not more than 33 semester hours earned by correspondence, and not more than 40 semester hours earned by correspondence and extension may be applied toward fulfillment of the requirements for graduation at State.

10. Before a student may receive credit for any correspondence course, all graded assignments must be returned to the Division of General Extension.

11. Division of General Extension shall report to the Registration Office all final grades in correspondence courses received by State students, using the same grading system as used by instructors teaching courses in residence; i.e., A, B, C, D, F. & Inc. Such grades then become a part of the student's permanent record subject to the appropriate regulations.

12. Students approaching graduation may complete not more than six hours of work by correspondence after their last residence.

North Carolina State

1965

Short Courses

and

Conferences

Short Courses and Conferences

North Carolina State's Division of General Extension offers a comprehensive program of short courses, conferences and seminars in divergent areas ranging from agriculture to nuclear science.

These programs, designed to serve the adult education needs of the state and the region, fill a major need for continuing education in professional or avocational fields.

All short courses are non-credit and are usually offered in connection with the academic departments or schools on the campus. In most cases, professional associations and societies also cooperate in the presentation of these courses.

These programs are conducted, not only on the State campus, but in many locations across the state—from Hatteras on the coast to the Blue Ridge in the west.

Information concerning any courses offered at North Carolina State can be obtained by writing the Division of General Extension, North Carolina State, PO Box 5125, Raleigh, N. C. A brochure for each program is available from the above address.

COURSES

January through June, 1965

January

3-5	Nurserymen's Short Course
4-29	N. C. Truck Driver Training School
7-8	Swine Conference
11-12	Pesticide School
14-15	Cattlemen's Conference
25-2/5	Modern Farming Short Course
26-28	State Highway Conference
27-28	Soil Science School
27-29	Pest Control Operator's School

February

1-26	N. C. Truck Driver Training School
8-10	Brick and Tile Sales Conference
17-18	Public Works Conference
17-18	Dairymen's Conference
19-20	Farm—Press, Radio and TV Institute
23-25	Roofing, Sheet Metal and Air Conditioning Forum
23-25	Bovine Sterility Short Course

March

1-26	N. C. Truck Driver Training School
4-6	Industrial Recreation Workshop
4-5	Poultry Servicemen Short Course
16-18	Flower Show School—Course II
8-11	Warm Air Heating and Air Conditioning Short Course
9-12	Southeastern Park and Recreation Institute
20-21	NCPA Mechanical Conference
22-25	Industrial Ventilation Conference
29-4/23	N. C. Truck Driver Training School
30-31	Hospital Food Service Institute

April

5-10	Artificial Breeding Short Course
8-9	Electrical Supervisors Conference
12-16	Maintenance of Commercal Vehicles Short Course
26-30	Motor Fleet Supervisors Training Course

May

3-5	University Reactor Utilzation Conference
3-28	N. C. Truck Driver Training School
12-14	Swimming Pool Clinic
31-6/4	Municipal Fire Administration Course
	Commercial Flower Growers Short Course
31-6/25	N. C. Truck Driver Training School
31-6/25	Western Electric Short Course
31-6/11	Textile Executive Short Tours
31-6/4	Textile Wet Processing

June

8-11	Electrical Meter School (Wilmington)
13-18	Sport Fishing Short Course (Hatteras)
14-16	Creative Problem Solving Short Course
14-25	Cotton Classing Short Course
14-18 & 28-7/2	Fire Administration Short Course
20-26	Baton Clinic
28-7/23	N. C. Truck Driver Training School
28-7/20	Summer Institute of Nuclear Engineering

July

12-16	Municipal Fire Administration Short Course
19-23	Telegraphy Fire Alarm Technology

August

10-12	Flower Show School—Course III

September

(Date to be announced)	Industrial Recreation Workshop

North Carolina State

Night Classes 1965

(CREDIT AND NON-CREDIT)

AND

ON-CAMPUS EVENING COLLEGE

Extension Night Classes

The Division of General Extension operates an extensive extension night class program across the state. In Raleigh, all classes offered by the division are non-credit. However, in other sections of the state there are credit classes being offered all during the year.

Also, although not connected with the General Extension Division, there is a program of credit courses offered at night on the campus through the Office of Admissions and Registration.

The non-credit campus program usually offers a variety of avocation courses during the spring semester which open in early February. The credit courses are available in many locations across the state, with the largest concentration being at Ft. Bragg.

The Ft. Bragg program last year drew more than 3,000 students for a combined college-course program numbering 104 courses (five terms). Other communities in which extension night classes were offered included Kinston, Charlotte, Winston-Salem, Asheboro, Raleigh, Sanford, Burlington, Greensboro, Asheville, Salisbury, Newton, Wilson and Wilmington.

A complete listing of courses for the Ft. Bragg center can be obtained by writing the Division of General Extension, North Carolina State, PO Box 5125, Raleigh, N. C., or by going by the education office on the military reservation.

The following is a list of non-credit courses scheduled for the spring semester: **beginning and advanced painting, estate planning and taxation, glass blowing, interior decorating, income tax, photography, review class for the N. C. Engineering Review Examination, speed reading, woodworking, and blue print reading.**

Evening College

SPRING—1965

Course	No.	Course Title	Credits	Section	Time	Location
		SCHOOL OF AGRICULTURE				
AGC	592	Topical Problems Agricultural Economics	3	1	7-10 M	208 Patterson
CS	511	Tobacco Technology	2	1	4-6 T	285 Williams
EPD	501	Leadership	3	1	7-10 W	362 Harrelson
EPD	503	Programming Process Adult Education	3	1	1-4 F	117 Riddick
EPD	690	Seminar	1	1	1-3 W	428 Mann
RS	541	Social Agencies and Programs	3	1	3:30-6 M	216 Winston
RS	633	Rural Community	3	1	7-10 T	222 Winston
		SCHOOL OF EDUCATION				
ED	305	Analysis of Technical Education Problems and Course Construction	3	1	4-5:30 MW	113 Tompkins
ED	410	Driver Education	3	1	9-12S	2 Fieldhouse
ED	418	Educational Sociology	3	1	Arranged	216 Winston
ED	421	Principles and Practices in Industrial Cooperative Training	3	1	4-7 Th	113 Tompkins
			4	2	4-7 T	111B Tompkins
ED	422	Methods of Teaching Industrial Subjects	2	1	4-5:30 T	113 Tompkins
ED	440	Vocational Education	2	1	4-5:30 Th	114 Tompkins
ED	483	Instructional Aid and Devices	3	1	4-7 W	212 Tompkins
ED	503	Improvement of Reading Abalities	3	1	4-7 M	
ED	524	Occupational Information	3	1	5:30-8 T	111 Tompkins
ED	529	Curriculum Materials Development	3	1	4-7 W	211 Tompkins
ED	533	Organization and Administration of Guidance Services	3	1	7-10 M	113 Tompkins
ED	554	Planning Programs in Agricultural Education	3	1	Arranged	211 Tompkins
ED	590	Individual Problems in Guidance			Arranged	123 Tompkins
ED	593	Special Problems				

Course	*No.*	*Course Title*	*Credits*	*Section*	*Time*	*Location*
ED	610	Administration and Supervision of Vocational Education	3	1	4-7 T	114 Tompkins
ED	615	Introduction to Educational Research	3	1	4-7 M	115 Tompkins
ED	617	Philosophy of Agricultural Education	3	1	7-10 T	114 Tompkins
ED	633	Techniques of Counseling	3	1	4-7 T	211 Tompkins
ED	641	Lab and Practicum Experiences in Counseling	3	1	Arranged	211 Tompkins
ED	699	Research		1	Arranged	119 Tompkins
PSY	200	Introduction to Psychology	3	7	7-10 M	213 Tompkins
PSY	411	Social Psychology	3	1	4-5:30 TTh	107 Winston
PSY	504	Advanced Educational Psychology	3	1	4-7 Th	211 Tompkins
PSY	535	Tests and Measurements	3	1	4-7 W	213 Tompkins
PSY	550	Mental Hygiene in Teaching	3	1	4-5:30 TTh	213 Tompkins
PSY	565	Industrial Management Psychology	3	1	3-5 TTh	212 Tompkins
PSY	576	Developmental Psychology	3	1	4-5:30 WF	107 Winston
		SCHOOL OF ENGINEERING				
E	102	Engineering Graphics II	1	31	7-8:30 TTh	316 Broughton
EM	200	Introduction to Mechanics	3	7	6:45-8 TTh	119 Harrelson
EM	301	Mechanics I	3	5	6:45-8 TTh	141 Harrelson
EM	303	Fluid Mechanics I	3	4	6:45-8 TTh	172 Harrelson
IE	607	Special Topics Mathematical Programming	3	35	6:45-8 TTh	320 Riddick
		SCHOOL OF LIBERAL ARTS				
EC	202	Economics	3	4	7-10 W	174 Harrelson
EC	312	Accounting I	3	7	7-10 Th	176 Harrelson
EC	313	Accounting II	3	3	7-10 W	176 Harrelson
EC	407	Business Law I	3	4	7-10 M	172 Harrelson
EC	425	Industrial Management	3	1	7-10 M	174 Harrelson
ENG	111	Composition and Rhetoric	3	19	6:45-8 MW	108 Winston
ENG	112	Composition and Reading	3	66	8-10 MW	108 Winston
ENG	205	Reading for Discovery	3	20	6:45-8 TTh	104 Winston
ENG	266	American Literature II	3	4	6:45-8 TTh	106 Winston

HI	246	History European Civilization	3	12	6-8 TTh	168 Harrelson
HI	252	U. S. Since Reconstruction	3	2	7-10 M	168 Harrelson
MLR	102	Russian Grammar and Prose Reading	3	2	6:45-8 MW	231 Harrelson
PS	201	The American Governmental System	3	13	6-8 TTh	178 Harrelson
PS	502	Public Administration	3	1	7-10 M	178 Harrelson
SOC	202	Principals of Sociology	3	9	7-10 M	358 Harrelson
SOC	304	Contemporary Family Life	3	2	7-10 T	362 Harrelson
SOC	401	Human Relations in Industrial Society	3	5	7-10 M	353 Harrelson
SOC	501	Leadership	3	3	7-10 W	362 Harrelson
SOC	502	Society, Culture and Personality	3	1	7-10 M	362 Harrelson

SCHOOL OF PHYSICAL SCIENCES AND APPLIED MATHEMATICS

CH	103	General Chemistry II	4	6	7-10 TTh	114 Withers
CH	223	Organic Chemistry II	4	4	7-10 T	105 Withers
CH	223	Organic Chemistry Lab		61	7-10 Th	304 Withers
MA	102	Analytic Geometry and Calculus I	4	30	8-10 MW	261 Harrelson
MA	201	Analytic Geometry and Calculus II	3	38	8-10 MW	266 Harrelson
MA	202	Analytic Geometry and Calculus III	4	17	8-10 MW	335 Harrelson
MA	301	Differential Equations I	3	18	6:45-8 MW	366 Harrelson

EXTENSION NIGHT CLASSES

(Offered on need basis. Listed locations indicate site of previous classes.)

ED 100—Introduction to Industrial Education
Charlotte
Salisbury

ED 305—Analysis of Industrial and Technical Education and Course Construction
Fayetteville
Sanford
Kinston

ED 327—History and Philosophy of Industrial Education
Sanford
Wilmington
Wilson

ED 405—Industrial and Technical Education Shop and Lab Planning
Sanford
Raleigh
Kinston

ED 440—Vocation Education
Burlington
Raleigh
Greensboro
Asheville

ED 442—Methods of Teaching Industrial Subjects
Charlotte
Greensboro
Salisbury

ED 483—Industrial Aids and Devices
Newton
Charlotte

ED 591—Special Problems in Industrial Education

ED 626—Seminar in Industrial Education
Raleigh
Sanford
Asheville
Salisbury
Kinston

ED 592—Special Problems in Mathematics Teaching
Yanceyville

MA 381—Special Topics in Mathematics
Yanceyville

MA 441—Advanced Calculus I
Charlotte

EE 503—Linear Network Theory
Winston-Salem

EM 556—Dynamics II
Charlotte

Advanced Lighting Design
Greensboro
Charlotte

Application Information

The ways and means for securing an application for various General Extension Division courses and for summer school programs will vary. The following will detail the correct procedure for securing applications for the specific courses in which you may be interested:

SUMMER SCHOOL—An application for admission to summer school can be obtained by writing directly to the Director of Summer School, North Carolina State, Raleigh, N. C. If you are in the vicinity stop by room 103 Peele Hall, the Admissions Office, or Building 1911 on the University campus and pick up an application.

HOME STUDY COURSES: An application for a correspondence course can be obtained by writing to the Division of General Extension, PO Box 5125, Raleigh, N. C. You may also come by Building 1911 on the University campus and pick up an application.

SHORT COURSES: Write to the Division of General Extension, PO Box 5125, Raleigh, N. C., and ask for a brochure for the specific course you wish to attend. You may also ask to be added to the permanent mailing list of any course. An application is also available if you come by Building 1911 on the University campus.

EXTENSION NIGHT CLASSES: A brochure and application form for non-credit courses are available from the Division of General Extension, PO Box 5125, Raleigh, or from the extension night class office in Building 1911, State campus. An application for credit courses out of the Raleigh area is available at the same location.

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"CONTINUING
HIGHER
EDUCATION"_____1965